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Copley

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(54) **SYSTEM AND METHOD OF PERFORMING FORCED DEFAULT ROUTING OF CALLS**

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(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

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(22) Filed: **Dec. 22, 1999**

(51) **Int. Cl.**[7] **H04M 7/00**
(52) **U.S. Cl.** **379/221.03**; 379/229
(58) **Field of Search** 379/221.03, 220.01, 379/229, 230, 207.14

(56) **References Cited**

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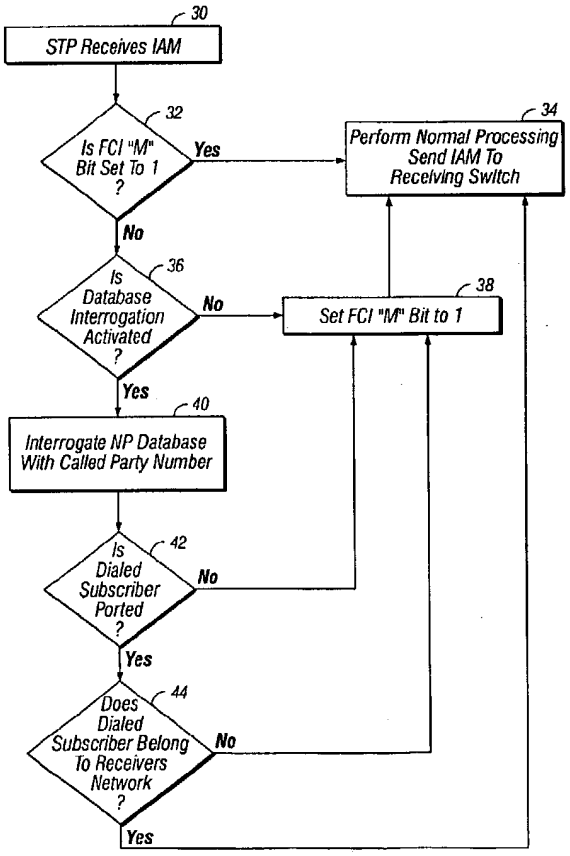
Primary Examiner—Ahmad F. Matar
Assistant Examiner—Hector Agdeppa
(74) *Attorney, Agent, or Firm*—Baker Botts, LLP; V. Lawrence Sewell; Craig A. Hoersten

(57) **ABSTRACT**

A telecommunications network (**1**) includes a signal transfer point (**10**) that receives an initial address message from a service switching point (**12**). The signal transfer point (**10**) determines whether a Forward Call Identifier (FCI) "m" bit has been set indicating that a local number portability (LNP) query has been performed. If the FCI "m" bit has been set, then the signal transfer point (**10**) performs normal call processing. If the FCI "m" bit is not set, the signal transfer point (**10**) will set the FCI "m" bit to one prior to performing normal processing if a database interrogation is not activated. If database interrogation is activated, the signal transfer point (**10**) interrogates a LNP database **24** to determine whether the dialed subscriber has been ported and/or resides in a receiving network. The signal transfer point (**10**) will set the FCI "m" bit in response to either the dialed subscriber not being ported or not residing in the receiving network prior to normal processing. The FCI "m" bit will remain at a zero state if the dialed subscriber has been ported and resides in the receiving network.

20 Claims, 2 Drawing Sheets



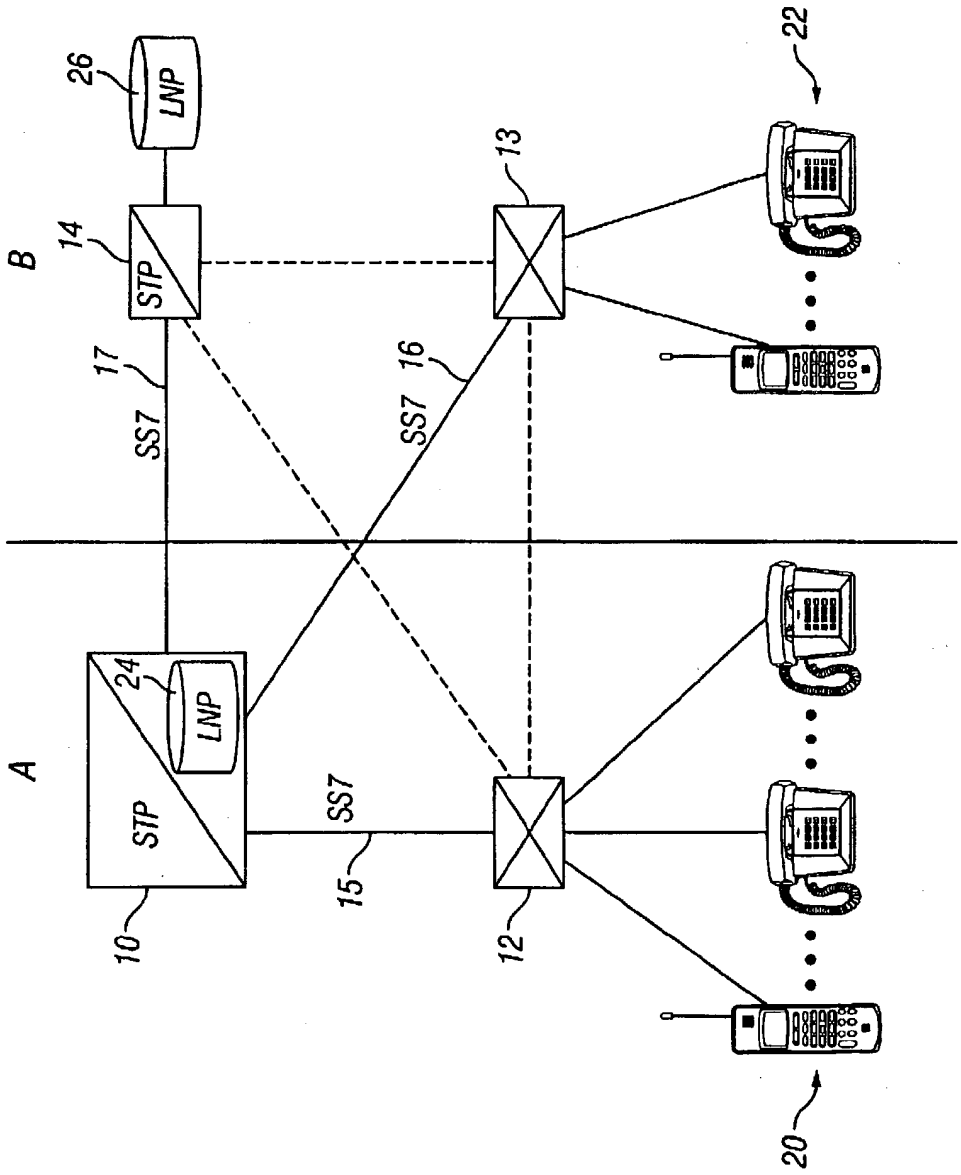


FIG. 1

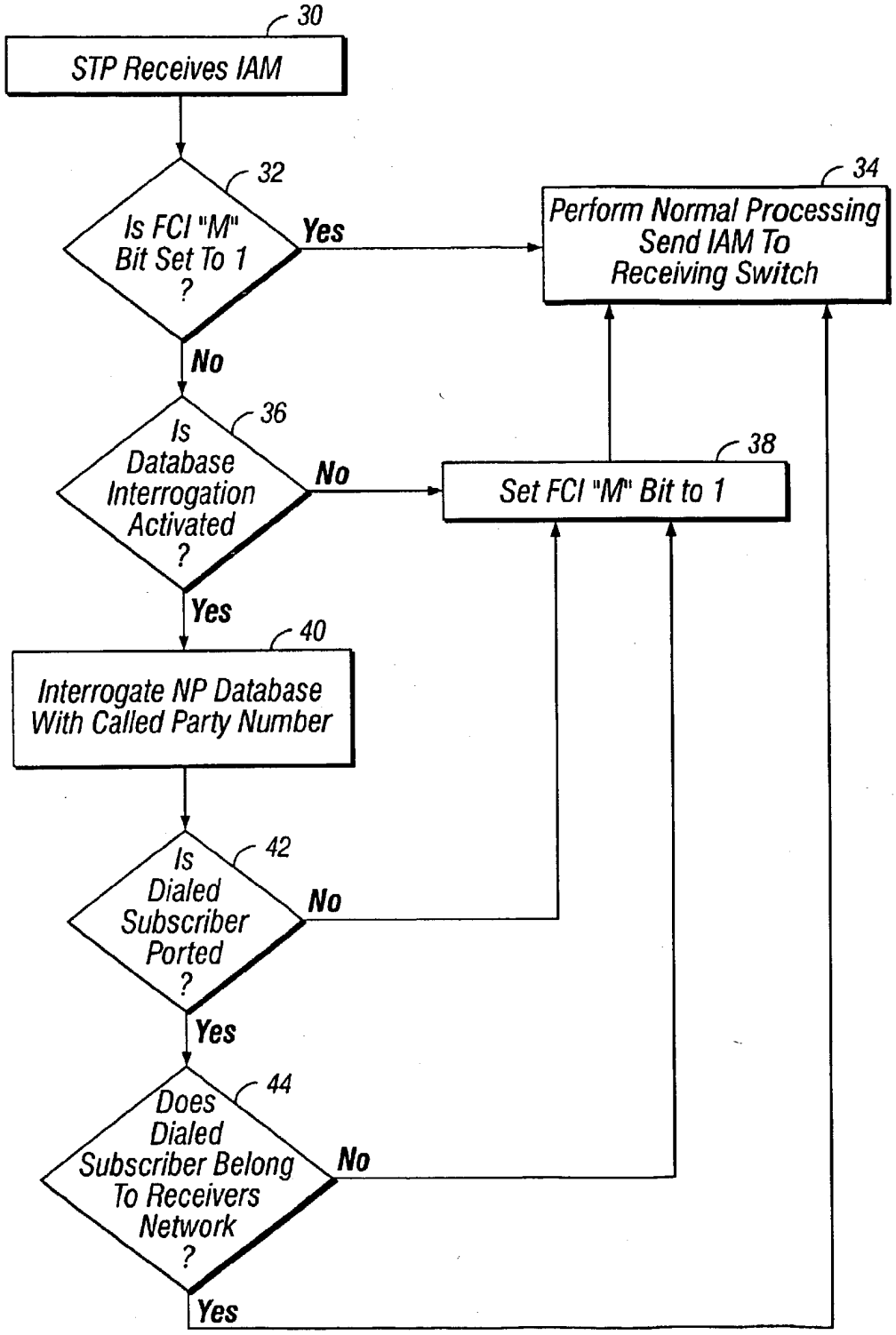

30
STP Receives IAM
32
Is FCI "M" Bit Set To 1 ?
Yes
34
Perform Normal Processing Send IAM To Receiving Switch
No
36
Is Database Interrogation Activated ?
No
38
Set FCI "M" Bit to 1
Yes
40
Interrogate NP Database With Called Party Number
42
Is Dialed Subscriber Ported ?
No
Yes
44
Does Dialed Subscriber Belong To Receivers Network ?
No
Yes

FIG. 2

SYSTEM AND METHOD OF PERFORMING FORCED DEFAULT ROUTING OF CALLS

TECHNICAL FIELD OF THE INVENTION

This invention is related in general to telecommunications call processing and more particularly to a system and method of performing forced default routing of calls.

BACKGROUND OF THE INVENTION

The network evolution as a result of the Telecommunication Act of 1996 has resulted in the need for specific procedures to support the ability of customers to change from one telecommunications service provider to another (hereafter referred to as Number Portability (NP)). Specific procedures and standards were developed by the telecommunications industry to support NP. The magnitude of these changes are significant and have created situations that can potentially stress network technology to the point of a catastrophic network event. Scenarios of financial management have also been created.

In most cases, a query is required for call delivery in an NP environment. The query consists of a Signaling System Number 7 (SS7) message sent from a query-originating switch to a network database to obtain the necessary routing information to route the call. The solution to achieve this is called the Location Routing Number (LRN) solution. When a customer places a call to a ported subscriber, the dialed number is sent in a query to the LRN application. The application returns the LRN which is then used by the querying switch and subsequent switches to route the call to the network element that has the same Network Routing Address (NRA) as the LRN. The querying switch places the called number into the Generic Address Parameter (GAP) of the IAM and marks the call as a queried call. This instructs downstream switching equipment that further querying is not necessary. It also provides the far-end switch with the appropriate dialed number information. Upon receipt at the far-end switch, the GAP and Called Party Address are reversed for service support and call completion.

The volume of queries to be performed in a network consists of wireless to wireline calls and calls that previously have not been dipped prior to arriving in the receiving network. This volume can be significant based on the number of non-queried calls delivered to the receiving network. Non-queried calls come from Competitive Local Exchange Carrier (CLECs) networks and Inter-exchange Carrier (IECs) networks that do not have the ability to perform queries or for some reason one or more of these networks did not perform the NP query (for example, a network outage of the NP Database). Of note, wireless networks were not scheduled to have query capabilities until Dec. 31, 1998 as indicated in the Telecommunications Act of 1996. As such, they will deliver traffic as normal to the incumbent wireline networks and expect the incumbent networks to perform the necessary NP query processing. The incumbent networks must have sufficient capacity engineered to handle this expanded need. The incumbent network is also allowed some form of cost recovery and management.

An incumbent network may be flooded with non-queried messages due to an event in an adjacent network. A failure in the adjacent network may cause all calls to be default routed to the incumbent network. This type of event could foreseeably drive the incumbent's network equipment beyond its engineered capacity and as such the incumbent may lose its ability to effectively process calls. Therefore, it is desirable to process calls to avoid this congestion in the network.

SUMMARY OF THE INVENTION

From the foregoing, it may be appreciated by those skilled in the art that a need has arisen for an improved technique to handle calls in a number portability environment. In accordance with the present invention, a system and method of performing forced default routing of calls are provided that substantially eliminate or reduce disadvantages and problems associated with conventional number portability call processing techniques.

According to an embodiment of the present invention, there is provided a method of performing forced default routing of calls that includes receiving an initial address message associated with a call placed to a called party number. A forward call indicator bit is identified within the initial address message. A determination is made as to whether the forward call indicator bit is in a first state, the first state indicating that a local number portability query has not been performed for the initial address message. In response to determining that the forward call indicator bit was received in the first state, the forward call indicator bit is placed into a second state. The initial address message is transmitted for subsequent processing of the call based on the called party number without performing a local number portability query.

The present invention has various technical advantages over conventional number portability processing techniques. For example, one technical advantage is to force processing of a call based on the called party number without going through a database query. Another technical advantage of the present invention is to eliminate use of the Generic Address Parameter in the Initial Address Message. Yet another technical advantage is to provide query relief at tandem switches. Other technical advantages may be readily apparent to those skilled in the art from the following figures, description, and claims.

BRIEF DESCRIPTION OF THE DRAWINGS

For a more complete understanding of the present invention and the advantages thereof, reference is made to the following description taken in conjunction with the accompanying drawings, wherein like reference numbers represent like parts, in which:

FIG. 1 illustrates a block diagram of a telecommunications network;

FIG. 2 illustrates a process to perform forced default routing in a signal transfer point of the telecommunications network.

DETAILED DESCRIPTION OF THE INVENTION

FIG. 1 shows a telecommunications network **1**. Telecommunications network **1** includes a signal transfer point **10** coupled to one or more service switching points **12** and **13** via Signalling System Number 7 (SS7) link sets **15** and **16**. Signal transfer point **10** is also coupled to at least one other signal transfer point **14** via SS7 link sets **17**. Service switching points **12** and **13** are further interconnected by trunks and may include a mobile services switching center (MSC) of a wireless service provider and one or more access tandem switch. Service switching points **12** and **13** are coupled to or otherwise in communication with telecommu-

nications equipment **20** and **22** of telephone service subscribers. In order to perform local number portability (LNP), signal transfer point **10** and **14** each have access to an LNP database **24** and **26**, respectively. LNP databases **24** and **26** contain the ported telephone numbers and the corresponding local routing numbers. If service switching point **12** of a service provider does not have LNP capabilities, it may have a business arrangement with another service provider who owns signal transfer point **14** to provide the LNP lookup in its LNP database **26** to obtain the local routing numbers. However, the cost of these types of arrangements are becoming cost prohibitive.

Number Portability (NP) as defined today, puts the decision to query the NP database in the hands of the switching system. Using FIG. **1**, calls are routed from service switching point **12** in network A to service switching point **13** in network B. If network A has not performed an NP query prior to delivery of the call to network B, then it will be up to network B to perform the query. Even if the call is to a non-ported subscriber (in a portable area), network B in this example will in most cases be required to perform the query.

Incoming internetwork calls are typically delivered to a receiving network's service switching point. If the Forward Call Indicators (FCI) "m" bit is NOT set and the dialed number is served within a portable area, then the access tandem would be forced to launch a query to determine the proper route for the call. The capability defined herein intercepts messages incoming on STP link sets. This capability sets the FCI "m" bit if it has not already been set. The setting of this bit instructs the receiving switch to not perform the query and to route based on the Called Party Number field. Calls to subscribers within the receiving network are delivered to subscribers' serving switches. Calls to subscribers not in the receiving network receive vacant call treatment back to the originating network.

The Forward Call Indicators (FCI) "m" bit is currently carried in the mandatory FCI parameter within the Integrated Services Digital Network User Part (ISUP) Initial Address Message (IAM) used for call setup. This FCI "m" bit is set by the switch performing an NP query. The setting of the bit indicates to downstream switches and networks that a query to the NP database has been performed and is therefore not needed.

Forced Default Routing (FDR) is a Signal Transfer Point (STP) capability that monitors number portability traffic received from other networks and sets the query indication based on message investigation applied against default and specified criteria. This achieves the desired results in the receiving network albeit to prevent network event impacts or to provide cost recovery financial management.

Forced Default routing (FDR) is a capability that interrogates each through-switched ISUP IAM message. The FDR capability interrogates IAM messages received over designated link sets to see if the FCI "m" bit has value zero (i.e., an associated NP query has not been performed for this message).

This capability could potentially inhibit call delivery to subscribers that ported into the receiving network and whose associated call setup messages indicate that the call has not been dipped. To address this case, queries to the STP's NP Database are performed to see if the dialed number belongs to a subscriber in the receiving network. If the subscriber belongs to the receiving network, the FCI "m" bit is not set thus instructing the receiving network's switches to perform the NP query.

FIG. **2** shows the processing at signal transfer point **10** in performing forced default routing. The process begins at step **30** where signal transfer point **10** receives an IAM from service switching point **12**. The IAM indicates that a subscriber **20** has initiated a call by dialing a called party number. Signal transfer point **10** determines whether the FCI "m" bit in the IAM is set at step **32**. If so, a local number portability query has already been performed for this call and normal STP processing for the call occurs with the IAM being sent to the receiving service switching point **13** at step **34**.

If the FCI "m" bit is not set, a check is made to see if NP database interrogation is activated at step **36**. If not activated, the FCI "m" bit is set to one at step **38** followed by normal processing at step **34**. If activated, interrogation with LNP database **24** begins at step **40**. The called party number is used to interrogate LNP database **24**. The result of the interrogation determines whether the dialed subscriber has been ported and belongs to the receiving network.

At step **42**, if the dialed subscriber has not been ported, then the FCI "m" bit is set to one at step **38** followed by normal processing at step **34**. If the dialed subscriber has been ported, process flow proceeds to step **44** to see if the dialed subscriber belongs to the receiving network. If the dialed subscriber does not belong to the receiving network, the FCI "m" bit is set to one at step **38** followed by normal processing at step **34**. If the dialed subscriber belongs to the receiving network, The FCI "m" bit is not changed and remains at zero and normal processing occurs at step **34**. With the FCI "m" bit at zero, the receiving service switching point **13** and signal transfer point **14** perform the LNP database query check.

TABLE 1 ·

FDR DECISION TABLE

Table I summarizes the forced default routing process discussed above.

Case No.	Rec'vd FCI "m" bit value	Option on y/n?	Query NP DB y/n?	Ported y/n?	Receiving Network y/n?	Set "m" bit to one
1.	1	—	—	—	—	—
2.	0	n	n	—	—	y
3.	0	y	y	y	y	n
4.	0	y	y	y	n	y
5.	0	y	y	n	—	y

— = ignore

Upon completion of the above procedures, the ATP sends the FDR processed IAM to the originally intended receiving service switching point **13**. Upon receipt of the message, receiving service switching point **13** performs normal NP procedures. It queries LNP Database **26** if the FCI "m" bit is zero and then routes according to normal NP procedures. If the FCI "m" bit is one, it routes the call as indicated to a destination switch. If the dialed subscriber resides on the destination switch, then normal treatment is applied (i.e., attempt delivery to dialed subscriber). If the dialed subscriber is not resident to the destination switch, the call is dropped with treatment sent back to the originator. This capability has no interaction with the GAP parameter.

FDR permits call delivery to all incumbent subscribers in a receiving network. Special procedures are required to ensure processing of subscribers that have ported into or within the receiving network. The FCI bit is not set if the dialed subscriber is found to be a ported subscriber belonging to the receiving network, thus allowing call delivery to the destination switch via normal NP procedures. The FCI

bit is set to one if the dialed subscriber is not a subscriber of the receiving network, thus resulting in eventual vacant code treatment at the destination switch.

Several alternatives exist for determining if the dialed subscriber belongs to the receiving network. Each alternative is optional and selectable by the customer. In a first alternative, the ported subscriber's LRN is checked against a network specific LRN. In this first alternative, the dialed number is used to retrieve the LRN from LNP database **24**. The LRN is then checked against a list of network specific LRNs. The subscriber is identified as belonging to the receiving network if the retrieved LRN is found in the network specific LRN list. The subscriber is identified as not belonging to the receiving network if the retrieved LRN is not found in the network specific LRN list.

In a second alternative, the ported subscriber's Service Provider is checked. The Service Provider Identifiers for the old and new networks are downloaded from the Number Portability Administration Center (NPAC) to the Local SMS for each ported subscriber. With this alternative, the Local SMS needs to download the "new" service provider identifier with each ported subscriber record sent to LNP database **24**. A service provider identifier is associated with each ported subscriber record in LNP database **24**. The dialed number is used to access the subscriber's record in LNP database **24** and interrogate the Service Provider Identifier field to determine if the subscriber belongs to the receiving network.

In a third alternative, the destination point code (DPC) in the Calling Name Delivery (CNAM) Global Title Translation (GTT) entry for the dialed subscriber number is checked. The dialed number is used to access the Calling Name Delivery (CNAM) Global Title Translation (GTT) entry in LNP database **24** and retrieve the destination point code (DPC) field. If the Network Identifier field of the retrieved DPC is that of the receiving network, then the subscriber is identified as belonging to the receiving network.

IAM messages for calls to ported subscribers identified as belonging to other networks may optionally be discarded based on user provisioning. To perform the screening function, the capability to identify network owned ported subscribers is required. Provisioning for this screening capability is provided on a link set basis.

Case 5, Table 1 provides the capability where the FCI "m" bit is set to one if the dialed subscriber is not ported. This capability is called Non-Ported Intercept Processing (NIP). The NIP capability is an option available with the other capabilities or as a stand-alone capability. It is activated on a link set basis.

The present invention provides local number portability query relief at service switching points and access tandems of a telecommunications network. By pre-processing the IAMs, failures at the switching points in the network due to query message overload may be avoided. Policing functions may be performed for networks refusing to pay query charges. A firewall may be established from events that occur in adjacent networks. Subscriber ownership can be determined as well as screening of LNP data.

Thus, it is apparent that there has been provided, in accordance with the present invention, a system and method of performing forced default routing of calls in a signal transfer point are provided that satisfy the advantages set forth above. Although the present invention has been described in detail, it should be understood that various changes, substitutions, and alterations may be readily ascertainable by those skilled in the art and may be made herein without departing from the spirit and scope of the present invention as defined by the following claims.

What is claimed is:

1. A method of performing forced default routing of calls, comprising:

receiving an initial address message associated with a call destined for a dialed subscriber according to a called party number;

identifying a forward call indicator bit within the initial address message;

determining whether the forward call indicator bit is in a first state, the first state indicating that a local number portability query has not been performed for the initial address message;

determining whether a database interrogation capability is activated in response to the forward call indicator bit being in the first state;

placing the forward call indicator bit into a second state in response to the database interrogation capability not being activated;

transmitting the initial address message for subsequent processing of the call according to the called party number without performing a local number portability query.

2. The method of claim **1**, further comprising:

transmitting the initial address message for subsequent processing of the call in response to the forward call indicator bit not being in the first state.

3. The method of claim **1**, further comprising:

interrogating a database with the called party number in response to the database interrogation capability being activated.

4. The method of claim **3**, further comprising:

determining whether the dialed subscriber has been ported in response to the interrogation.

5. The method of claim **4**, further comprising:

placing the forward call indicator bit into a second state in response to the dialed subscriber not being ported.

6. The method of claim **4**, further comprising:

determining whether the dialed subscriber belongs to a receiving network in response to the dialed subscriber being ported.

7. The method of claim **6**, further comprising:

placing the forward call indicator bit into a second state in response to the dialed subscriber not belonging to the receiving network.

8. The method of claim **6**, further comprising:

transmitting the initial address message for subsequent processing of the call in response to the dialed subscriber belonging to the receiving network, the forward call indicator bit remaining in the first state.

9. The method of claim **1**, wherein all steps are performed in a signal transfer point of a telecommunications network.

10. The method of claim **6**, wherein determining whether the dialed subscriber belongs to a receiving network includes:

retrieving a local routing number associated with the called party number;

comparing the retrieved local routing number to a list of network specific routing numbers, the dialed subscriber belonging to the receiving network in response to the retrieved local routing number also being in the list of network specific routing numbers.

11. The method of claim 6, wherein determining whether the dialed subscriber belongs to a receiving network includes:

accessing a record of the dialed subscriber according to the called party number;

comparing a service provider identifier in the dialed subscriber's record to the receiving network, the dialed subscriber belonging to the receiving network upon such indication provided by the service provider identifier.

12. The method of claim 6, wherein determining whether the dialed subscriber belongs to a receiving network includes:

accessing a calling name delivery global title translation entry associated with the called party number;

retrieving a destination point code field in the entry;

comparing a network identifier in the destination point code field to the receiving network, the dialed subscriber belonging to the receiving network in response to the network identifier having a value corresponding to the receiving network.

13. A telecommunication system for performing forced default routing of calls, comprising:

an originating service switching point operable to process a call to a dialed subscriber in response to a called party number received from an originating subscriber;

a signal transfer point operable to receive an initial address message from the service switching point, the initial address message including the called party number and a forward call indicator bit, the signal transfer point operable to determine whether the forward call indicator bit is in a first or second state, the first state indicating that a local number portability query has not been performed for the initial address message, the signal transfer point operable to determining whether a database interrogation capability is activated in response to the forward call indicator bit being in the first state, the signal transfer point operable to place the forward call indicator bit into a second state in response to the database interrogation capability not being activated, the signal transfer point operable to transmit the initial address message for subsequent processing of the call according to the called party number without performing a local number portability query.

14. The system of claim 13, wherein the signal transfer point is operable to transmit the initial address message for subsequent processing of the call in response to the forward call indicator bit being in the second state.

15. The system of claim 13, further comprising:

a database coupled to the signal transfer point, the signal transfer point operable to interrogate the database with the called party number in response to the database interrogation capability being activated.

16. The system of claim 15, wherein the signal transfer point is operable to determine whether the dialed subscriber has been ported in response to the interrogation, the signal transfer point operable to place the forward call indicator bit into a second state in response to the dialed subscriber not being ported.

17. The system of claim 15, wherein the signal transfer point is operable to determine whether the dialed subscriber has been ported in response to the interrogation, the signal transfer point operable to determine whether the dialed subscriber belongs to a receiving network in response to a determination that the dialed subscriber has been ported, the signal transfer point operable to place the forward call indicator bit into a second state in response to the dialed subscriber not belonging to the receiving network.

18. The system of claim 15, wherein the signal transfer point is operable to determine whether the dialed subscriber has been ported in response to the interrogation, the signal transfer point operable to determine whether the dialed subscriber belongs to a receiving network in response to a determination that the dialed subscriber has been ported, the signal transfer point operable to transmit the initial address message for subsequent processing of the call in response to the dialed subscriber belonging to the receiving network, the forward call indicator bit remaining in the first state.

19. The system of claim 13, further comprising:

a receiving service switching point operable to receive the initial address message from the signal transfer point, the receiving service switching point operable to process the call according to the initial address message.

20. The system of claim 19, further comprising:

a receiving signal transfer point operable to receive the initial address message from the receiving service switching point in order to complete the call according to the initial address message.

* * * * *

US005797103A

United States Patent [19]

Duda

[11] Patent Number: 5,797,103

[45] Date of Patent: *Aug. 18, 1998

[54] **METHOD AND APPARATUS FOR INFORMING A REMOTE UNIT OF A FEATURE-ORIGINATED CALL**

[75] Inventor: **Michael Duda**, Naperville, Ill.

[73] Assignee: **Motorola, Inc.**, Schaumburg, Ill.

[*] Notice: This patent issued on a continued prosecution application filed under 37 CFR 1.53(d), and is subject to the twenty year patent term provisions of 35 U.S.C. 154(a)(2).

[21] Appl. No.: **663,967**

[22] Filed: **Jun. 14, 1996**

[51] **Int. Cl.**[6] **H04B 1/38**; H04M 3/42

[52] **U.S. Cl.** **455/567**; 455/413; 455/414; 455/466

[58] **Field of Search** 455/54.1, 54.2, 455/67.1, 67.7, 343, 412, 413, 414, 415, 416, 417; 379/57, 58, 59, 60, 63, 89

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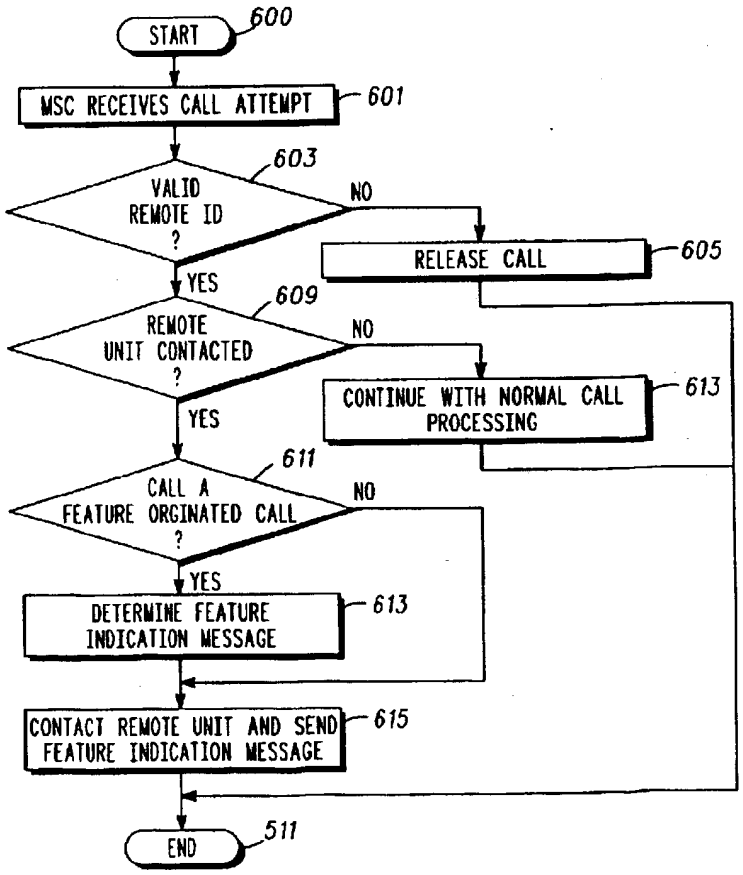
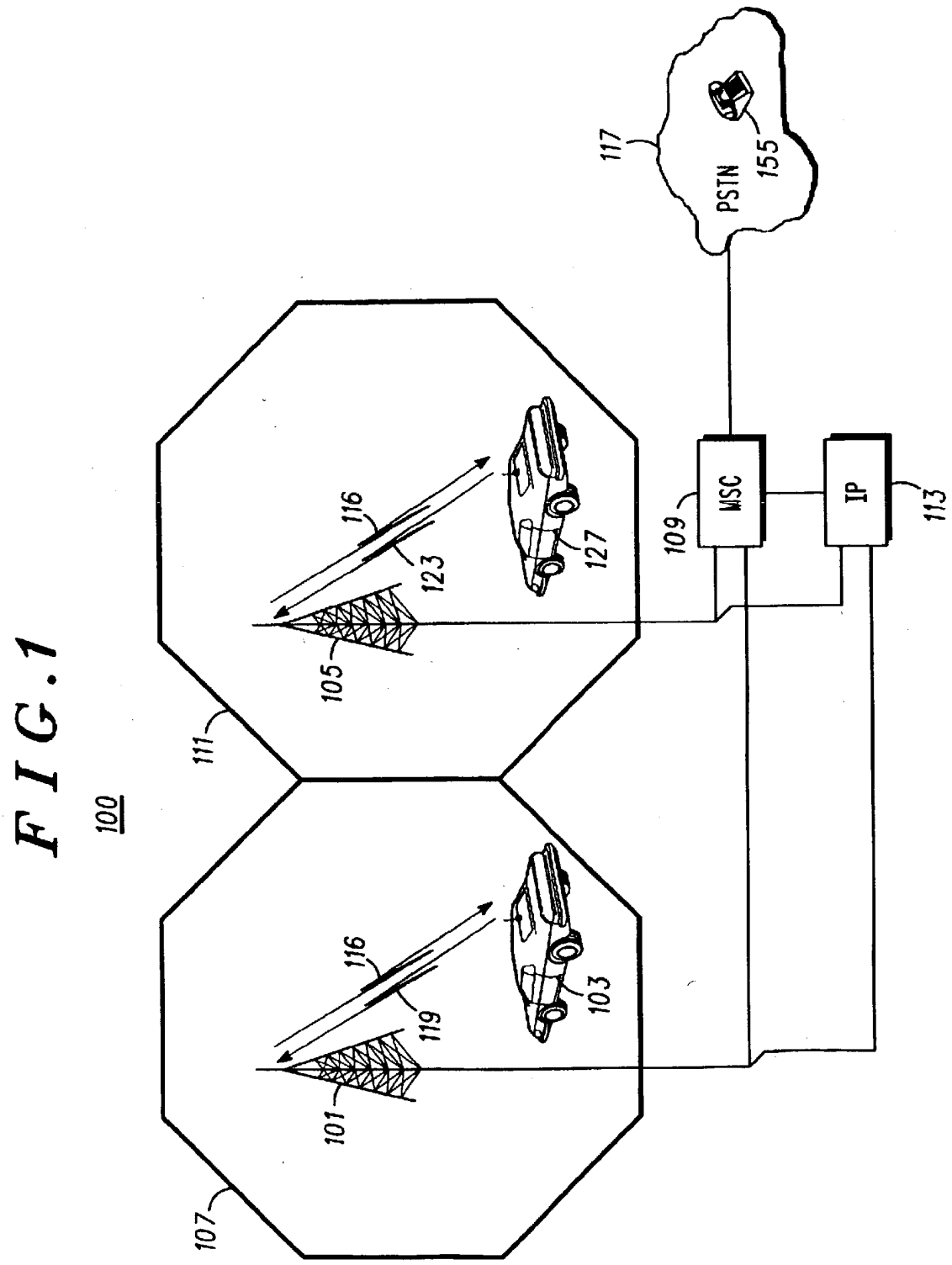
Primary Examiner—Edward F. Urban
Assistant Examiner—Sam Bhattacharya
Attorney, Agent, or Firm—Kenneth A. Haas

[57] **ABSTRACT**

Notification of a feature-originated call is provided to a remote unit (**103**) by determining a feature indication message (**312**) based on a feature-originated call, and sending the remote unit (**103**) the feature indication message (**538**). The feature indication message is sent to the remote unit (**103**) via a base station (**101**) utilizing a downlink communication signal (**116**). In a preferred embodiment the feature indication message consists of a predetermined text message transmitted to the remote unit (**103**) and is displayed by the remote unit (**103**) on an alpha-numeric display.

15 Claims, 5 Drawing Sheets




117
PSTN
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MSC
IP
113
111
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123
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105
107
116
119
103
101

FIG. 1

100

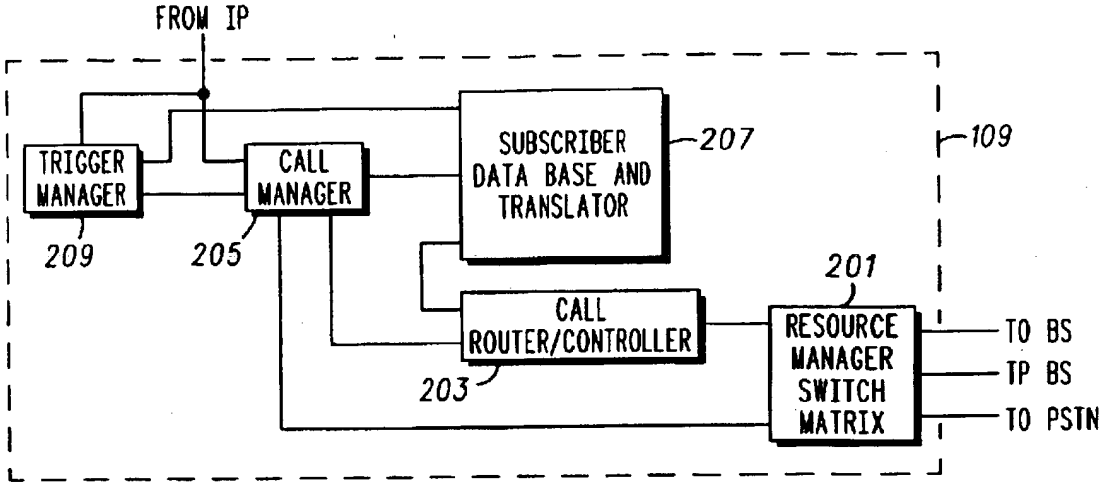
FROM IP
TRIGGER MANAGER
209
CALL MANAGER
205
SUBSCRIBER DATA BASE AND TRANSLATOR
207
109
CALL ROUTER/CONTROLLER
203
201
RESOURCE MANAGER SWITCH MATRIX
TO BS
TP BS
TO PSTN

FIG. 2

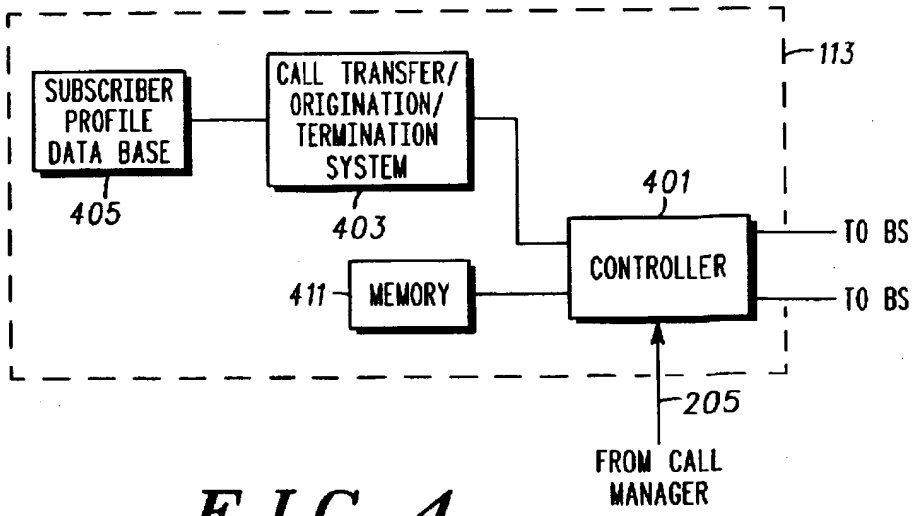
SUBSCRIBER PROFILE DATA BASE
405
CALL TRANSFER/ ORIGINATION/ TERMINATION SYSTEM
403
113
401
CONTROLLER
TO BS
TO BS
411
MEMORY
205
FROM CALL MANAGER

FIG. 4

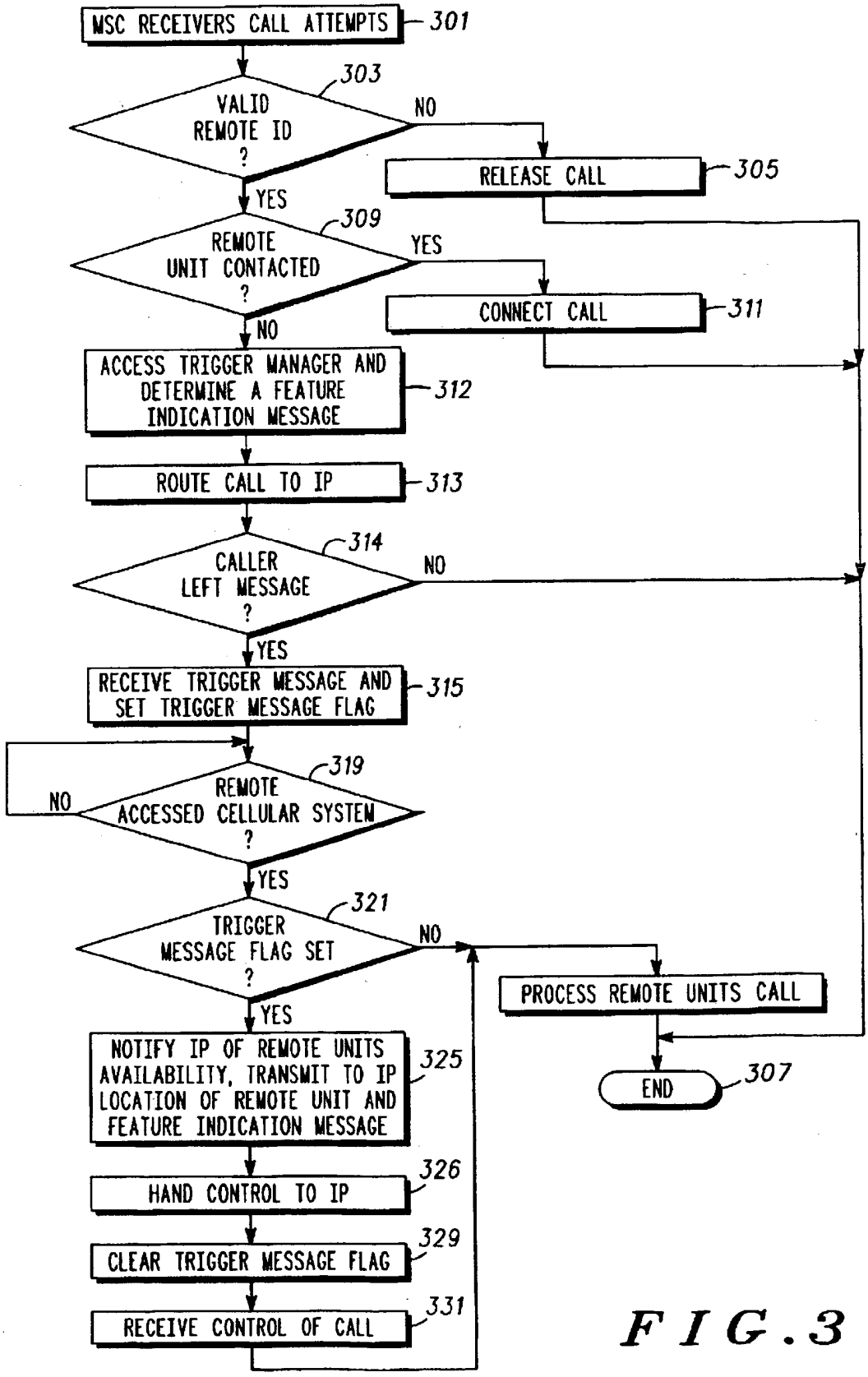
MSC RECEIVERS CALL ATTEMPTS
301
303
VALID REMOTE ID ?
NO
RELEASE CALL
305
YES
309
REMOTE UNIT CONTACTED ?
YES
CONNECT CALL
311
NO
ACCESS TRIGGER MANAGER AND DETERMINE A FEATURE INDICATION MESSAGE
312
ROUTE CALL TO IP
313
314
CALLER LEFT MESSAGE ?
NO
YES
RECEIVE TRIGGER MESSAGE AND SET TRIGGER MESSAGE FLAG
315
319
NO
REMOTE ACCESSED CELLULAR SYSTEM ?
YES
321
TRIGGER MESSAGE FLAG SET ?
NO
PROCESS REMOTE UNITS CALL
YES
NOTIFY IP OF REMOTE UNITS AVAILABILITY, TRANSMIT TO IP LOCATION OF REMOTE UNIT AND FEATURE INDICATION MESSAGE
325
HAND CONTROL TO IP
326
CLEAR TRIGGER MESSAGE FLAG
329
RECEIVE CONTROL OF CALL
331
END
307

FIG. 3

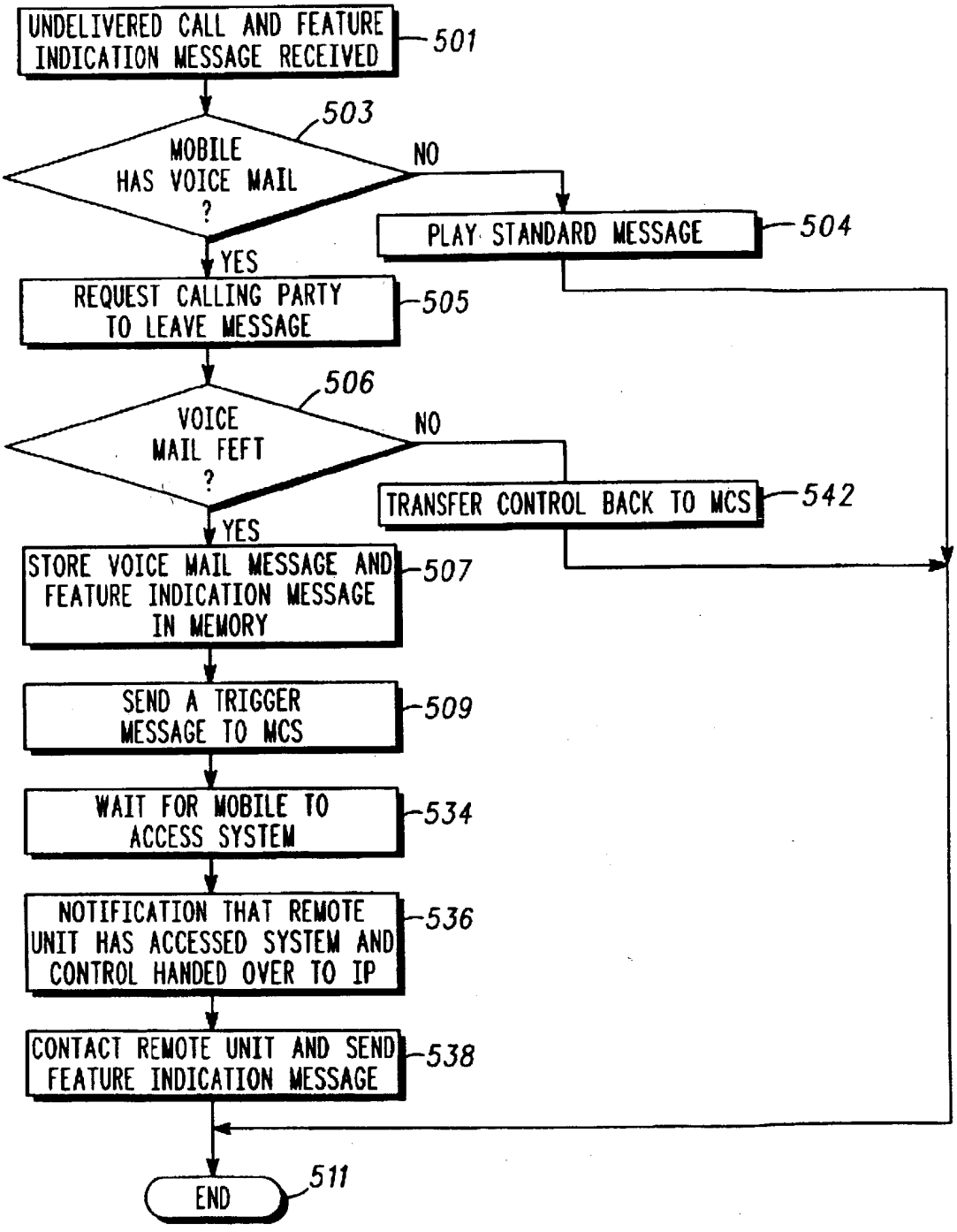
UNDELIVERED CALL AND FEATURE INDICATION MESSAGE RECEIVED
501
503
MOBILE HAS VOICE MAIL ?
NO
PLAY STANDARD MESSAGE
504
YES
REQUEST CALLING PARTY TO LEAVE MESSAGE
505
506
VOICE MAIL FEFT ?
NO
TRANSFER CONTROL BACK TO MCS
542
YES
STORE VOICE MAIL MESSAGE AND FEATURE INDICATION MESSAGE IN MEMORY
507
SEND A TRIGGER MESSAGE TO MCS
509
WAIT FOR MOBILE TO ACCESS SYSTEM
534
NOTIFICATION THAT REMOTE UNIT HAS ACCESSED SYSTEM AND CONTROL HANDED OVER TO IP
536
CONTACT REMOTE UNIT AND SEND FEATURE INDICATION MESSAGE
538
END
511

FIG. 5

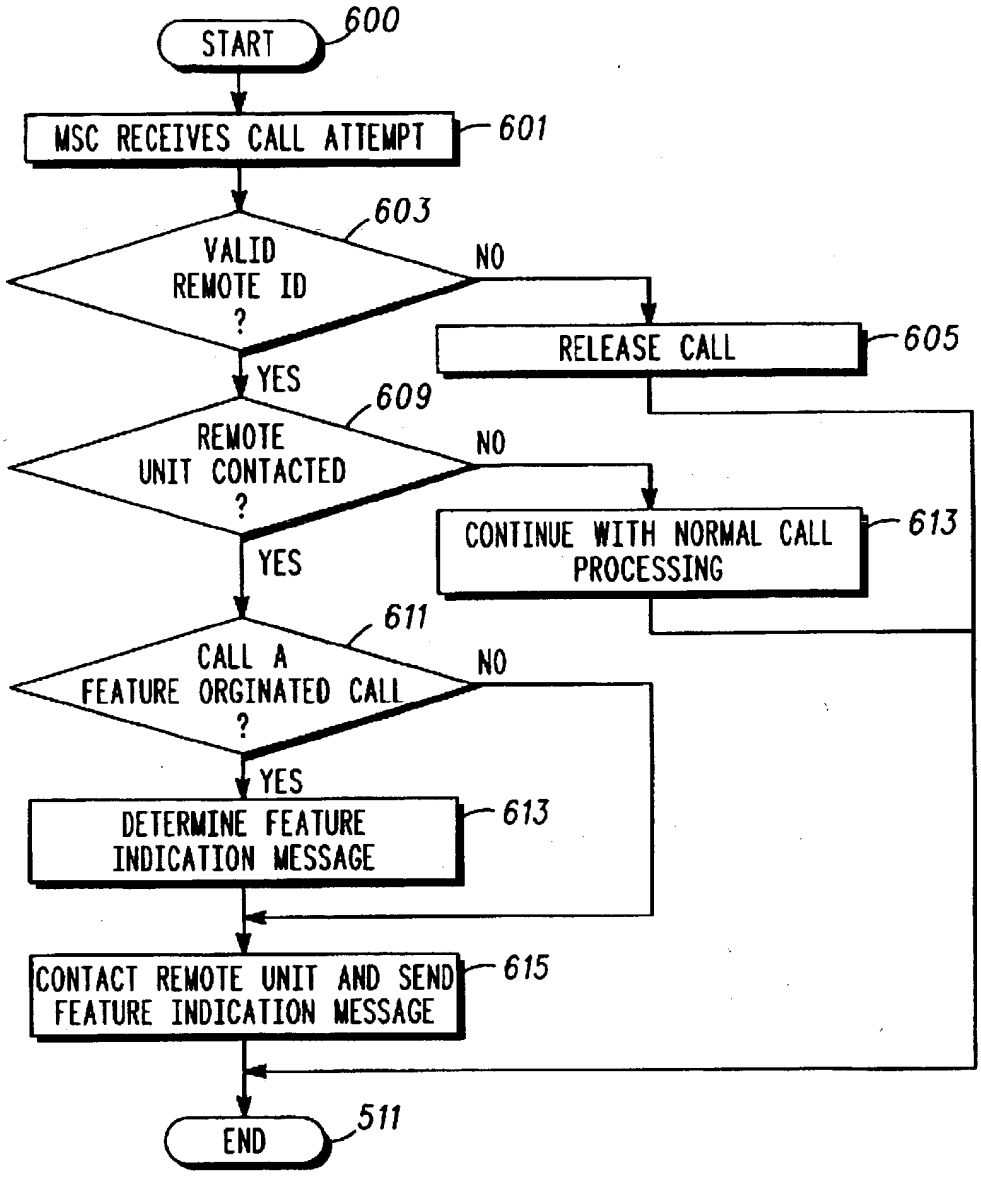
START
600
MSC RECEIVES CALL ATTEMPT
601
VALID REMOTE ID ?
603
NO
RELEASE CALL
605
YES
REMOTE UNIT CONTACTED ?
609
NO
CONTINUE WITH NORMAL CALL PROCESSING
613
YES
CALL A FEATURE ORGINATED CALL ?
611
NO
YES
DETERMINE FEATURE INDICATION MESSAGE
613
CONTACT REMOTE UNIT AND SEND FEATURE INDICATION MESSAGE
615
END
511

FIG. 6

METHOD AND APPARATUS FOR INFORMING A REMOTE UNIT OF A FEATURE-ORIGINATED CALL

FIELD OF THE INVENTION

The present invention relates generally to wireless communication systems and, in particular, to informing a remote unit in a wireless communication system of a feature-originated call.

BACKGROUND OF THE INVENTION

Wireless communication systems are known to comprise feature services such as voice mail, caller identification, call forwarding, etc. In particular, when a feature-originated call is placed to a remote unit (e.g., a mobile or stationary remote unit), the receiver of that call has no indication that a feature-originated call has been placed, and typically will answer the call as if a third party were trying to contact them. For many feature-originated calls (such as voice-mail notification), the called party will have to pay unnecessary fees by answering the feature-originated call since their feature service may be accessed via the Public Switched Telephone Network (PSTN) at a typically much lower cost.

In other feature-originated calls (such as transmission of data or facsimile), the called party will answer the call without attaching the necessary equipment to the remote unit, often resulting in a dropped call. Even if the necessary equipment can be attached to the remote unit without the call being dropped, at a minimum the user is billed for the air time while connecting the necessary equipment.

Thus a need exists for a method and apparatus for informing a remote unit of a feature-originated call.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a wireless communication system in accordance with a preferred embodiment of the invention.

FIG. **2** is a block diagram illustrating the mobile switching center of FIG. **1**.

FIG. **3** is a flow chart illustrating a preferred method of operating the mobile switching center of FIG. **1**.

FIG. **4** is a block diagram illustrating the intelligent peripheral of FIG. **1**.

FIG. **5** is a flow chart illustrating a preferred method of operating the intelligent peripheral of FIG. **1**.

FIG. **6** is a flow chart illustrating a method of operating the wireless communication system of FIG. **1** in accordance with an alternate embodiment of the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Stated generally, notification of a feature-originated call is provided to a remote unit by determining a feature indication message based on a feature-originated call and sending the feature indication message to the remote unit. The feature indication message is sent to the remote unit utilizing a base station and a downlink communication signal. In a preferred embodiment the feature indication message consists of a predetermined text message transmitted to the remote unit and is displayed by the remote unit on an alpha-numeric display.

The present invention encompasses a method for informing a remote unit of a feature-originated call by determining that a feature service needs to be provided to the remote unit and determining an availability of the remote unit. Next, a feature indication message is determined based on the feature service determination and a time period is determined in which the feature indication message is to be sent to the remote unit. Finally the feature indication message is sent to the remote unit based on the feature service determination, the availability of the remote unit, and the time period determination. By informing a remote unit that an incoming call is a feature-originated call, the called party may avoid unnecessary fees by refusing to answer the call since their feature service may be accessed via a PSTN at a typically much lower cost.

An alternate embodiment encompasses a method for informing a remote unit of a feature-originated call by determining that a feature service needs to be provided to the remote unit and determining an availability of the remote unit. A feature indication message is determined based on the feature service determination, and a time period to send the feature indication message is determined. Next, the remote unit is contacted via a downlink communication signal and supplied the feature indication message via the downlink communication signal.

Yet another embodiment encompasses an apparatus for informing a remote unit of a feature-originated call. The apparatus comprises a Mobile Switching Center (MSC) for determining an availability of the remote unit, a trigger manager coupled to the MSC, the trigger manager determining a feature indication message based on a call, the trigger manager additionally determining a time period to send the feature indication message to the remote unit, a controller coupled to the MSC for contacting the remote unit via a downlink communication signal, and a base station coupled to the MSC, the base station supplying the remote unit the feature indication message via a downlink communication signal.

FIG. **1** illustrates wireless communication system **100** in accordance with a preferred embodiment of the present invention. Although communication system **100** is capable of supporting many feature services, a preferred embodiment of the present invention will be described as it relates to a voice mail feature-originated call. Wireless communication system **100** is preferably a cellular communication system **100** which may be an analog or digital cellular communication system **100**, such as Advanced Mobile Phone Service (AMPS) system, Code Division Multiple Access (CDMA) system, Global System for Mobile Communications (GSM) system, the Personal Digital Cellular (PDC) system, or the United States Digital Cellular (USDC).

Cellular communication system **100** includes wireless infrastructure equipment including base stations **101** and **105** which may be Motorola GSM base stations, having respective service coverage areas **107** and **111**. As shown, cellular communication system **100**includes remote unit **103** (sometimes referred to as a subscriber unit which is operated by a remote subscriber) communicating with base site **101** via uplink communication signal **119** and with downlink communication signal **116**. Additionally, communication system **100** includes remote unit **127** communicating with base site **105** via uplink communication signal **125** and via downlink communication signal **123**. Base stations **101** and **105** are suitably coupled, as is well known, to at least mobile switching center (MSC) **109** and intelligent peripheral (IP) **113**. In a preferred embodiment, MSC **109** is a Motorola Electronic Mobile Exchange (EMX) 2500 and IP **113** is a GSM Short Message Service Center manufactured by Aldiscon Telepath. In the preferred embodiment, MSC **109** is suitably coupled to both IP **113** and public switched telephone network (PSTN) **117**, but it is contemplated that MSC

109 can be suitably coupled to both IP 113 and other network communication devices as well. As shown, PSTN 117 contains communication unit 155.

Operation of cellular system 100 in accordance with a preferred embodiment of the invention occurs as follows. A call attempt is made to remote unit 103. The call attempt may originate from PSTN (i.e. from communication unit 155) or may originate from cellular system 100 (i.e. from remote unit 127). MSC 109 determines remote unit's 103 availability and, if necessary, attempts to locate remote unit 103 via downlink communication signal 116 sent to the last base station that remote unit 103 was in communication with. If remote unit 103 is unavailable, MSC 109 determines a feature indication message (in this case a voice-mail identification message) and reroutes the call and the feature indication message to IP 113. If remote unit 103 has subscribed for voice-mail services, IP 113 directs the calling party to leave a message for remote unit 103. If a message has been left for remote unit 103, IP 113 sends a trigger message to MSC 109 informing MSC 109 that IP 113 should be notified when remote unit 103 next accesses cellular system 100.

When remote unit 103 accesses cellular system 100 (e.g. location registration, originating call attempt, releasing an existing call . . . etc.) via uplink communication signal 119, MSC 109 notifies IP 113 that remote unit 103 is available for communication. IP 113 then establishes a connection via base station 101 and downlink communication signal 116, to remote unit 103. Once connection has been established between IP 113 and remote unit 103, IP 113 sends a feature indication message to remote unit 103 informing remote unit 103 that a voice-mail message has been left. In a preferred embodiment the feature indication message consists of a predetermined text message transmitted to remote unit 103 and displayed by remote unit 103 on an alpha-numeric display. In a preferred embodiment the feature indication message is an alpha-numeric message "you have voice mail" that is displayed on an alpha-numeric display existing on remote unit 103. By informing remote unit 103 that an incoming call is a feature-originated call, the called party may avoid unnecessary fees by refusing to answer the call since their voice-mail service may be accessed via PSTN 117 at a typically much lower cost.

In an alternate embodiment, if remote unit 103 is utilizing Cellular System Remote Unit-Base Station Compatibility Standard of the Electronic Industry Association/ Telecommunications Industry Association Interim Standard 95 (TIA/EIA/IS-95A), IP 113 may send an "Alert w/Info" order to remote unit 103 containing the text message in the "display" element, or may utilize a "short message service" to send the text message to remote unit 103. Additionally, if remote unit 103 is operating utilizing an IS-91 system protocol, IP 113 will send an Extended Protocol Message Order (sometimes referred to as a "Short Message") containing the predetermined text message to remote unit 103 followed by an Alert Order. In a preferred embodiment, messaging may be accomplished via a control channel or traffic channel utilizing the appropriate air interface and system protocol. EIA/TIA can be contacted at 2001 Pennsylvania Ave. NW Washington, D.C. 20006. Both EIA/TIA/IS-95-A and EIA/TIA/IS-91 are incorporated herein by reference. Once the information has been successfully delivered to remote unit 103, IP 113, instructs MSC 109 to clear the trigger message and hands control of remote unit 103 back to MSC 109.

FIG. 2 is a block diagram illustrating MSC 109 of FIG. 1. MSC 109 comprises trigger manager 209, call manager 205, subscriber database/translator 207, call router/controller 203, and resource manager/switch matrix 201. In a preferred embodiment, resource manager/switch matrix 201 is coupled to both call router/controller 203 and call manager 205 and call router/controller 203 is suitably coupled to both call manager 205 and subscriber database/translator 207. Resource manager/switch matrix 201 has outputs to base stations 101 and 105 and to PSTN 117. Trigger manager 209 (preferably a microprocessor based controller) is coupled to both call manager 205 and subscriber database/translator 207. Call manager 205, subscriber database/translator 207, and router/controller 203 are preferably microprocessor based controllers as described in Bellcore publication "Advanced Intelligent Network (AIN) 0.2 Switch-Intelligent Peripheral Interface (IPI) Generic Requirements" dated November, 1993.

FIG. 3 is a flow chart illustrating a particular embodiment of operating MSC 109 of FIG. 1 and FIG. 2. The logic flow begins at step 301, where MSC 109 receives a call attempt. Next, at step 303 call manager 205 accesses subscriber database/translator subsystem 207 and determines if a valid mobile identification was supplied by the call attempt. If, at step 303, subscriber database/translator 207 determines that the mobile identification is invalid, then at step 305, MSC 109 releases the call attempt, and the logic flow ends at step 307. If, at step 303, subscriber database/translator 207 determines that the mobile identification is valid, then at step 309, call manager 205 attempts to contact remote unit 103. In the preferred embodiment, the step of contacting remote unit 103 is accomplished via downlink communication signal 116 which is transmitted from the last base station that remote unit 103 communicated with. In situations where remote unit 103 is involved in a call, the step of contacting remote unit 103 is accomplished via down link communication on the traffic channel currently being utilized by remote unit 103.

Continuing, if at step 309, call manager 205 successfully contacts remote unit 103, then at step 311, the call is connected, and the logic flow ends at step 307. If at step 309, call manager 205 fails to contact remote unit 103, then at step 312 call manager 205 accesses trigger manager 209 where trigger manager determines a feature indication message and a corresponding time for the message to be sent to remote unit 103. In a preferred embodiment the feature indication message consists of a text message that is sent to remote unit 103 via a short message service the next time remote unit 103 accesses communication system 100, but in an alternate embodiment the feature indication message is sent to remote unit 103 only during specific time periods (for example, during time periods that have lower billing rates).

Continuing, at step 313, the undelivered call is rerouted to IP 113. At step 315 MSC 109 receives a trigger message from IP 113 and sets a trigger message flag instructing MSC 109 to notify IP 113 the next time remote unit 103 accesses cellular system. Next, at step 317, subscriber database/translator 207 sets a trigger message flag (in a preferred embodiment, the trigger message flag is simply a bit stored in memory) to notify IP 113 the next time remote unit 103 accesses cellular system. At step 319 call manager 205 determines if remote unit 103 has accessed cellular system. In the preferred embodiment, access can be accomplished by a location registration, originated call attempt, or releasing an existing call.

If at step 319 it is determined that remote unit has not accessed cellular system, the logic flow returns to step 319, otherwise the logic flow continues to step 321 where subscriber database/translator 207 checks to see if the trigger

message flag has been set to notify IP **113** of remote unit's **103** access to cellular system **100**. If no trigger message flag has been set, then at step **323** call manager **205** continues processing the system access, and the logic flow ends at step **307**. If at step **321** a trigger message flag has been set, then at step **325** call manager **205** notifies IP **113** that remote unit **103** is available and transmits to IP **113** the location (i.e. current base station) of remote unit **103** along with the feature indication message. Next, at step **326**, call manager **205** hands control of remote unit **103** to IP **113** which transmits a feature indication message to remote unit **103**, and at step **329**, subscriber database/translator **207** clears the trigger message flag. The logic flow continues to step **331**, where call manager **205** receives control of remote unit **103** from IP **113**, and continues processing remote unit's **103** system access.

Referring to FIG. **4**, a block diagram of a preferred embodiment of IP **113** of FIG. **1** is illustrated. IP **113** includes controller **401** (such as a microprocessor based controller), a memory serving as subscriber profile database **405**, call transfer/origination/termination (CTOT) system **403**, and memory **411**. In a preferred embodiment controller **401** has outputs to base station **101** and base station **105** and has an input from call manager **205**. Controller **401** is suitably coupled to CTOT system **403** with CTOT system **403** coupled to subscriber profile database. Additionally, memory **411** is coupled to caller controller **401**. Controller **401**, subscriber profile database **405**, and (CTOT) system **403** are preferably those as described in Bellcore publication "Advanced Intelligent Network (AIN) 0.2 Switch-Intelligent Peripheral Interface (IPI) Generic Requirements" dated November, 1993. This document can be obtained from Bellcore Customer Service, located at 8 Corporate Place, 3C183, Piscataway, N.J. 08854-4156.

FIG. **5** is a flow chart illustrating a method of operating IP **113** of FIG. **1** and FIG. **5**. The logic flow begins at step **501** where controller **401** receives a rerouted undelivered call and a feature indication message from MSC **109**. At step **503**, controller **401** accesses CTOT system **403** which determines if remote unit **103** has voice-mail capabilities. In the preferred embodiment, CTOT system **403** accomplishes this by accessing the subscriber profile data base **405** that contains the services that remote unit **103** has associated with it. If, at step **503** it is determined that remote unit **103** has voice-mail capabilities, then at step **505** CTOT system **403** requests the calling party to leave a message and the logic flow continues to step **507** where the voice-mail message and feature indication message is stored in memory **411**. The logic flow then continues to step **534** where controller **401** waits for remote unit **103** to access cellular system **100**.

At step **536** MSC **109** notifies controller **401** that remote unit **103** has accessed cellular system **100** and MSC **109** hands control of remote unit **103** to controller **401**. Next, at step **538**, controller **401** contacts remote unit **103** via base station **101** and downlink communication signal **116**. At this point controller **401** supplies remote unit **103** the feature indication message. As discussed above, in a preferred embodiment the feature indication message may be supplied via a short message service or "Alert w/Info" depending on the communication system protocol. Controller **401** accomplishes this by retrieving the feature indication message from memory **411** and supplying the feature indication message to base station **101** which transmits the feature indication message to remote unit **103** via downlink communication signal **116** and displayed on an alpha-numeric display screen. By informing remote unit **103** that an incoming call is a feature-originated call, the called party may avoid unnecessary fees by refusing to answer the call since their voice-mail service may be accessed via PSTN **117** at a typically much lower cost. Next, at step **542** controller **401** transfers control back to MSC **109** and the logic flow ends at step **511**.

FIG. **6** is a flow chart illustrating a method of operating wireless communication system **100** of FIG. **1** in accordance with an alternate embodiment of the present invention. The logic flow starts at step **600** where a feature-service call is placed to remote unit **103**. In the alternate embodiment, the call contains information that indicates the call is a feature-originated call. For example, a feature-service call such as a facsimile (FAX), which may originate from PSTN (i.e. from communication unit **155**) or cellular system **100** (i.e. from remote unit **127**), may be placed for remote unit **103**. In a preferred embodiment, the feature-service call contains information indicating it to be a feature-originated call. For example, in a preferred embodiment two-stage dialing is utilized, wherein the first stage contains feature indication information (such as a binary number indicating a feature) and the second stage contains the mobile destination number.

Continuing, at step **601** MSC **109** receives the call attempt and at step **603** call manager **205** accesses subscriber database/translator subsystem **207** and determines if a valid mobile identification was supplied by the call attempt. If, at step **603**, subscriber database/translator **207** determines that the mobile identification is invalid, then at step **605**, MSC **109** releases the call attempt, and the logic flow ends at step **607**. If, at step **603**, subscriber database/translator **207** determines that the mobile identification is valid, then at step **609**, call manager **205** attempts to contact remote unit **103**. In the preferred embodiment, the step of contacting remote unit **103** is accomplished via downlink communication signal **116** which is transmitted from the last base station that remote unit **103** communicated with. In situations where remote unit **103** is involved in a call, the step of contacting remote unit **103** is accomplished via down link communication on the traffic channel currently being utilized by remote unit **103**.

Continuing, if at step **609**, call manager **205** successfully contacts remote unit **103**, then at step **611**, call manager **205** determines if the call is a feature-originated call. As described above, in a preferred embodiment this determination is made by checking the first stage in a two-stage dialing process. If, at step **311** it is determined that the call is not a feature-originated call, then the logic flow continues to step **615** otherwise, at step **613** call manager determines a feature indication message associated with the two-stage dialing process and the logic flow continues to step **615**. At step **615**, call manager **205** contacts remote unit **103** via base station **101** and downlink communication signal **116**. At this point the feature indication message is provided to remote unit **103**. As discussed above, in a preferred embodiment the feature indication message may be supplied via a short message service or "Alert w/Info" depending on the communication system protocol.

Further advantages and modifications of the above described apparatus and method will readily occur to those skilled in the art. The invention, in its broader aspects, is therefore not limited to the specific details, representative apparatus, and illustrative examples shown and described above. Various modifications and variations can be made to the above specification without departing from the scope or spirit of the present invention, and it is intended that the present invention cover all such modifications and variations

provided they come within the scope of the following claims and their equivalents.

What is claimed is:

1. A method for informing a remote unit of a feature-originated call in a communication system where there exist a plurality of types of feature-originated calls, wherein the feature-originated call is being placed to the remote unit in response to a utilized feature service, the method comprising the steps of:

determining, by wireless infrastructure equipment in response to the utilized feature service that the feature-originated call needs to be provided to the remote unit to produce a feature service determination;

determining an availability of the remote unit;

determining a feature indication message based on the feature service determination, wherein the feature indication message is utilized to provide the remote unit with an indication of a specific type of feature-originated call from the plurality of feature-originated calls that needs to be provided to the remote unit;

determining a time period to send the feature indication message to produce a time period determination; and

simultaneously sending the feature indication message along with the feature-originated call to the remote unit informing the remote unit of the feature-originated call, wherein the step of sending the message and the call is based on the feature service determination, the availability of the remote unit, and the time period determination.

2. The method of claim 1 wherein the time period determination is a next time the remote unit accesses a cellular system.

3. The method of claim 1 wherein the step of sending the feature indication message comprises the step of sending the feature indication message over a control channel.

4. The method of claim 1 wherein the step of sending the feature indication message comprises the step of sending the feature indication message over a traffic channel.

5. The method of claim 1 wherein the feature indication message is a text message.

6. The method of claim 1 wherein the step of sending comprises sending an "Alert w/Info" order to the remote unit.

7. The method of claim 1 wherein the step of sending comprises sending a short message service to the remote unit.

8. A method for informing a remote unit of a feature-originated call in a communication system where there exist a plurality of types of feature-originated calls, wherein the feature-originated call is being placed to the remote unit in response to a utilized feature service, the method comprising the steps of:

determining, by wireless infrastructure equipment in response to the utilized feature service that the feature-originated call needs to be provided to the remote unit to produce a feature service determination;

determining an availability of the remote unit to produce an availability determination;

determining a feature indication message based on the feature service determination, wherein the feature indication message is utilized to provide the remote unit with an indication of a specific type of feature-originated call from the plurality of feature-originated calls that needs to be provided to the remote unit;

determining a time period to send the feature indication message to the remote unit contacting the remote unit via a downlink communication signal; and

simultaneously supplying the remote unit the feature indication message via the downlink communication signal and sending the feature-originated call to the remote unit to provide the remote unit with an indication of a type of feature-originated call, wherein the step of supplying and sending is based on the time period, the feature indication message, and the availability of the remote unit and is sent to the remote unit prior to providing the feature-originated call to the remote unit.

9. The method of claim 8 wherein the time period is a next time the remote unit accesses a cellular system.

10. The method of claim 8 wherein the step of supplying the remote unit the feature indication message comprises the step of sending the feature indication message over a control channel.

11. The method of claim 8 wherein the step of supplying the remote unit the feature indication message comprises the step of sending the feature indication message over a traffic channel.

12. The method of claim 8 wherein the feature indication message is a text message.

13. The method of claim 8 wherein the step of supplying comprises sending an "Alert w/Info" order to the remote unit.

14. The method of claim 8 wherein the step of supplying comprises sending a short message service to the remote unit.

15. An apparatus for informing a remote unit of a feature-originated call in a communication system where there exist a plurality of types of feature-originated calls, the apparatus comprising:

a Mobile Switching Center (MSC) for determining an availability of the remote unit to produce an availability determination;

a trigger manager coupled to the MSC, the trigger manager determining a feature indication message based on the feature-originated call, wherein the feature indication message is utilized to provide the remote unit with an indication of the specific type of feature-originated call from the plurality of feature-originated calls that needs to be provided to the remote unit, the trigger manager additionally determining a time period to send the feature indication message to the remote unit;

a controller coupled to the MSC for contacting the remote unit via a downlink communication signal;

a base station coupled to the MSC, the base station simultaneously supplying the remote unit the feature indication message and the feature-originated call via a downlink communication signal, wherein the step of supplying is based on the time period, the feature indication message, and the availability of the remote unit and is sent to the remote unit prior to providing the feature-originated call to the remote unit.

* * * * *

US006397055B1

(12) **United States Patent**
McHenry et al.

(10) **Patent No.: US 6,397,055 B1**
(45) **Date of Patent: May 28, 2002**

(54) **MOBILE TO MOBILE CALL DELIVERY FOR CALLING PARTY PAYS WIRELESS SERVICE**

(75) Inventors: **James McHenry**, Point Pleasant, PA (US); **John Nightingale**, Jamesburg, NJ (US)

(73) Assignee: **Bell Atlantic Mobile**, Bedminster, NJ (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) Appl. No.: **09/467,144**

(22) Filed: **Dec. 20, 1999**

(51) **Int. Cl.**[7] **H04M 11/00**; H04M 15/00; H04Q 7/20

(52) **U.S. Cl.** **455/408**; 455/406; 455/445; 379/114.05; 379/114.21; 379/114.28

(58) **Field of Search** 455/406, 408, 455/445, 417, 560, 433, 461; 379/221.02, 114.26, 114.28, 115.01, 114.05, 127.01, 220.01, 114.21

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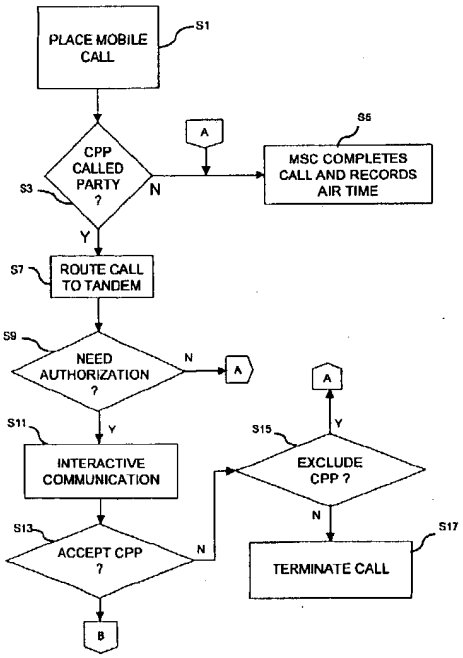
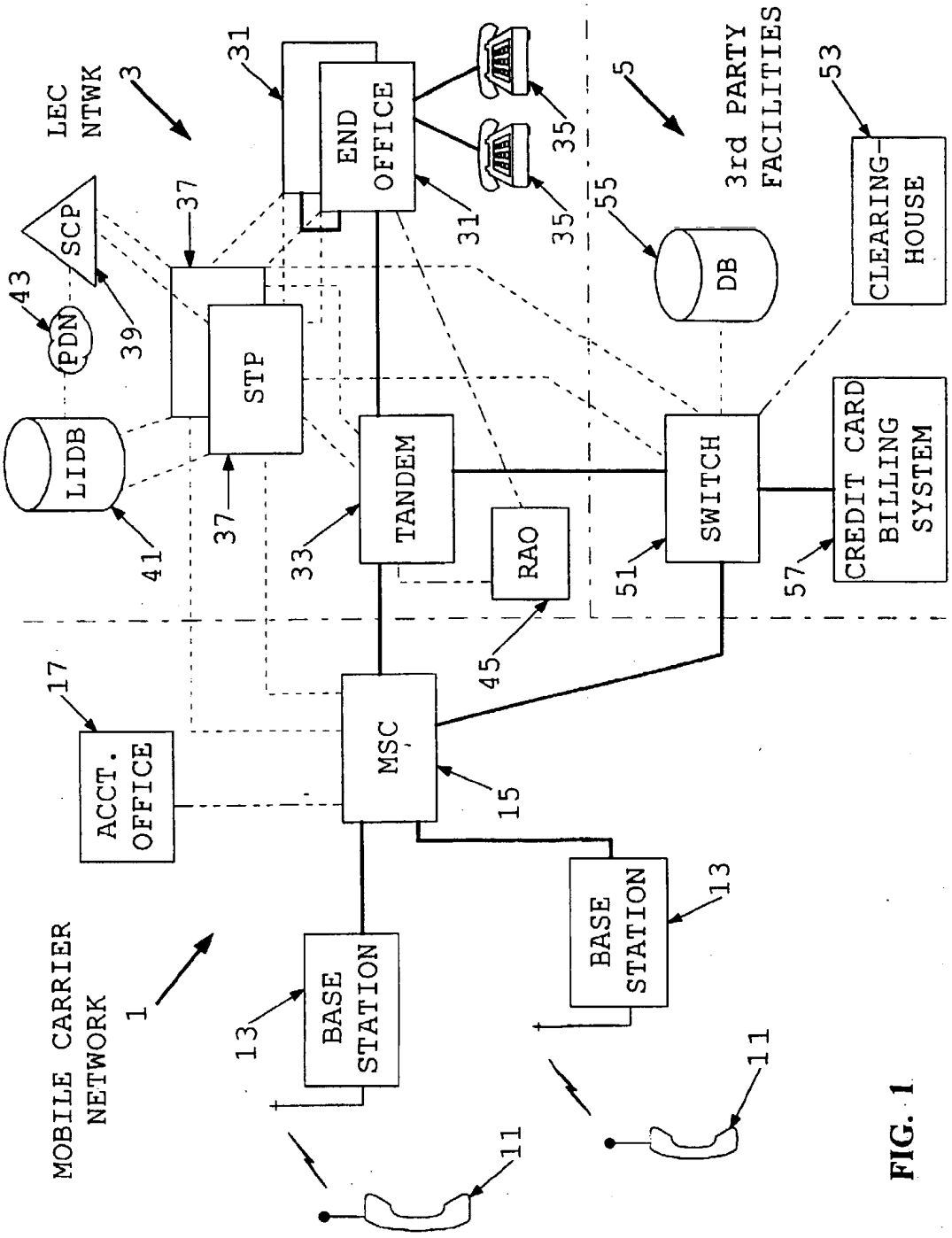
Primary Examiner—Nay Maung
Assistant Examiner—Ray B. Persino
(74) *Attorney, Agent, or Firm*—McDermott, Will & Emery

(57) **ABSTRACT**

Landline facilities are linked to a wireless mobile network for calling party pays calls between wireless subscriber units. The wireless mobile network is provided with the ability to recognize that a called wireless station is a calling party pays subscriber. The wireless mobile network routes the call to a landline facility to undertake interactive communication with the calling station to determine whether the caller will agree to pay for both the called party's air-time charges and the calling party's air-time charges for the call. The landline facility can then access a database to determine if the carrier with which it is associated can provide billing functions with respect to the calling subscriber and, if so, activate such functions for a carrier entity so identified. If the carrier cannot handle billing for the call, the call may then be routed to a clearinghouse facility, which either can itself handle the billing functions, if such an arrangement with the calling party has been previously established, or communicate with the caller to authorize billing charges to a credit card. The clearinghouse facility or an alternative processor platform can rate the call charges that will be applied to the credit card bill. The call can then be completed to the called station through the wireless communication network while rating of air-time charges for both calling and called parties takes place. Calling party pays service is provided for a mobile call originating from a prepaid mobile user.

22 Claims, 6 Drawing Sheets

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3
31
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CLEARING-HOUSE
SCP
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PDN
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STP
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DB
LIDB
41
37
33
TANDEM
RAO
45
SWITCH
51
CREDIT CARD BILLING SYSTEM
57
17
ACCT. OFFICE
MSC
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MOBILE CARRIER NETWORK
1
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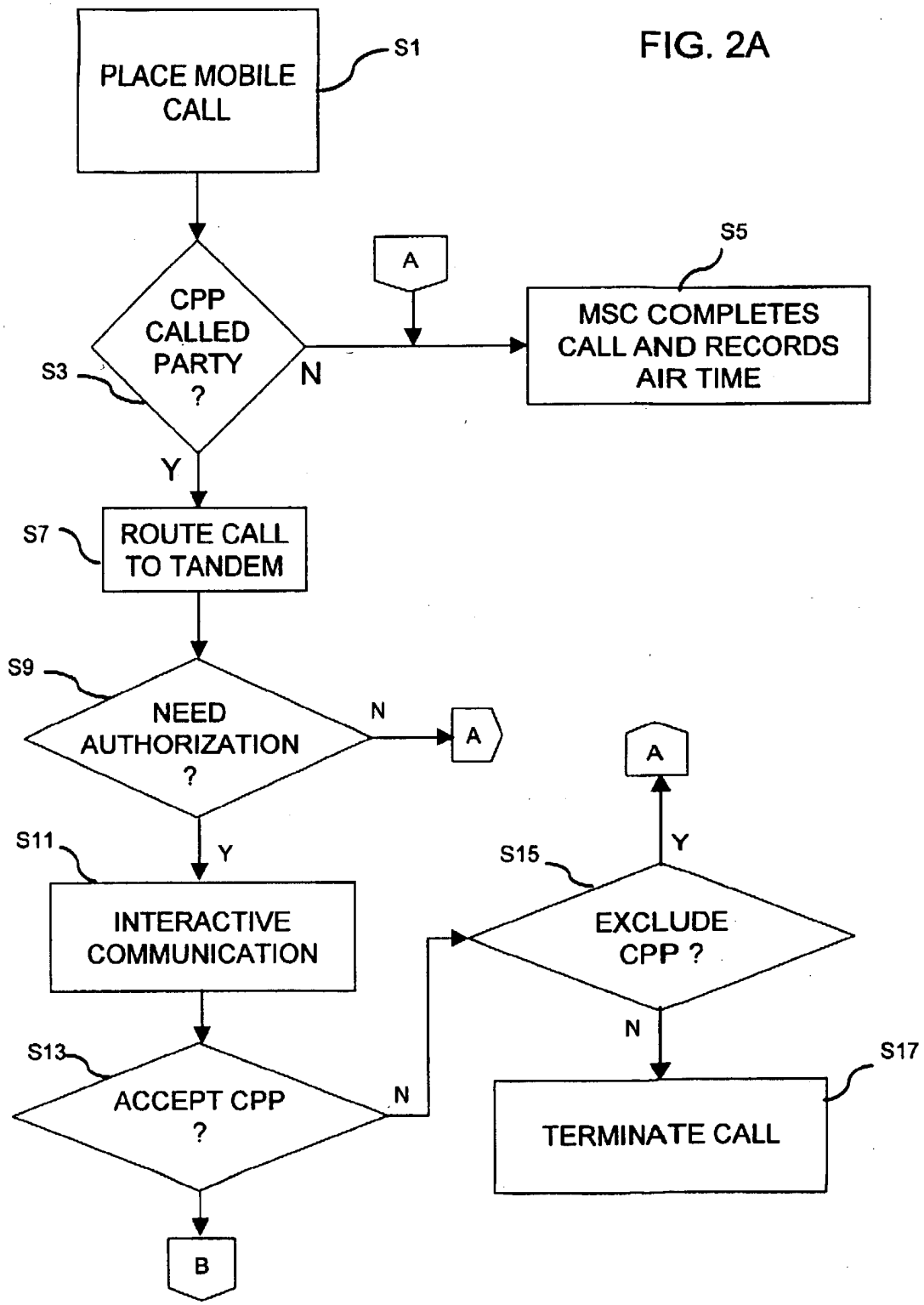
BASE STATION
13
BASE STATION
11
11

FIG. 1

FIG. 2A


PLACE MOBILE CALL
S1
CPP CALLED PARTY ?
S3
N
A
S5
MSC COMPLETES CALL AND RECORDS AIR TIME
Y
S7
ROUTE CALL TO TANDEM
S9
NEED AUTHORIZATION ?
N
A
Y
S11
INTERACTIVE COMMUNICATION
S13
ACCEPT CPP ?
N
B
A
Y
S15
EXCLUDE CPP ?
N
S17
TERMINATE CALL

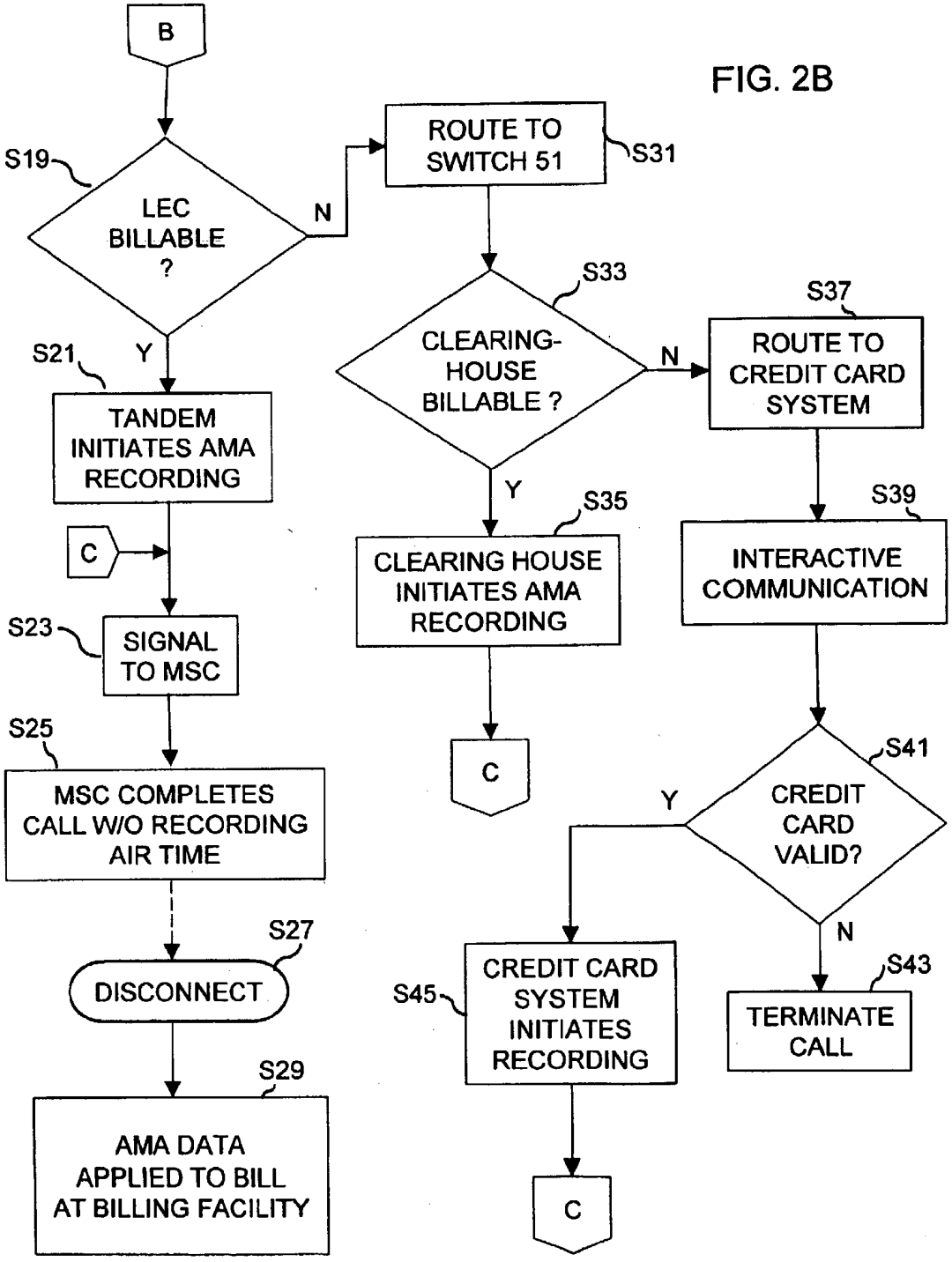

B
S19
LEC BILLABLE ?
N
ROUTE TO SWITCH 51
S31
Y
S21
TANDEM INITIATES AMA RECORDING
C
S23
SIGNAL TO MSC
S25
MSC COMPLETES CALL W/O RECORDING AIR TIME
S27
DISCONNECT
S29
AMA DATA APPLIED TO BILL AT BILLING FACILITY
S33
CLEARING-HOUSE BILLABLE ?
N
Y
S35
CLEARING HOUSE INITIATES AMA RECORDING
C
S37
ROUTE TO CREDIT CARD SYSTEM
S39
INTERACTIVE COMMUNICATION
S41
CREDIT CARD VALID?
Y
N
S43
TERMINATE CALL
S45
CREDIT CARD SYSTEM INITIATES RECORDING
C

FIG. 2B

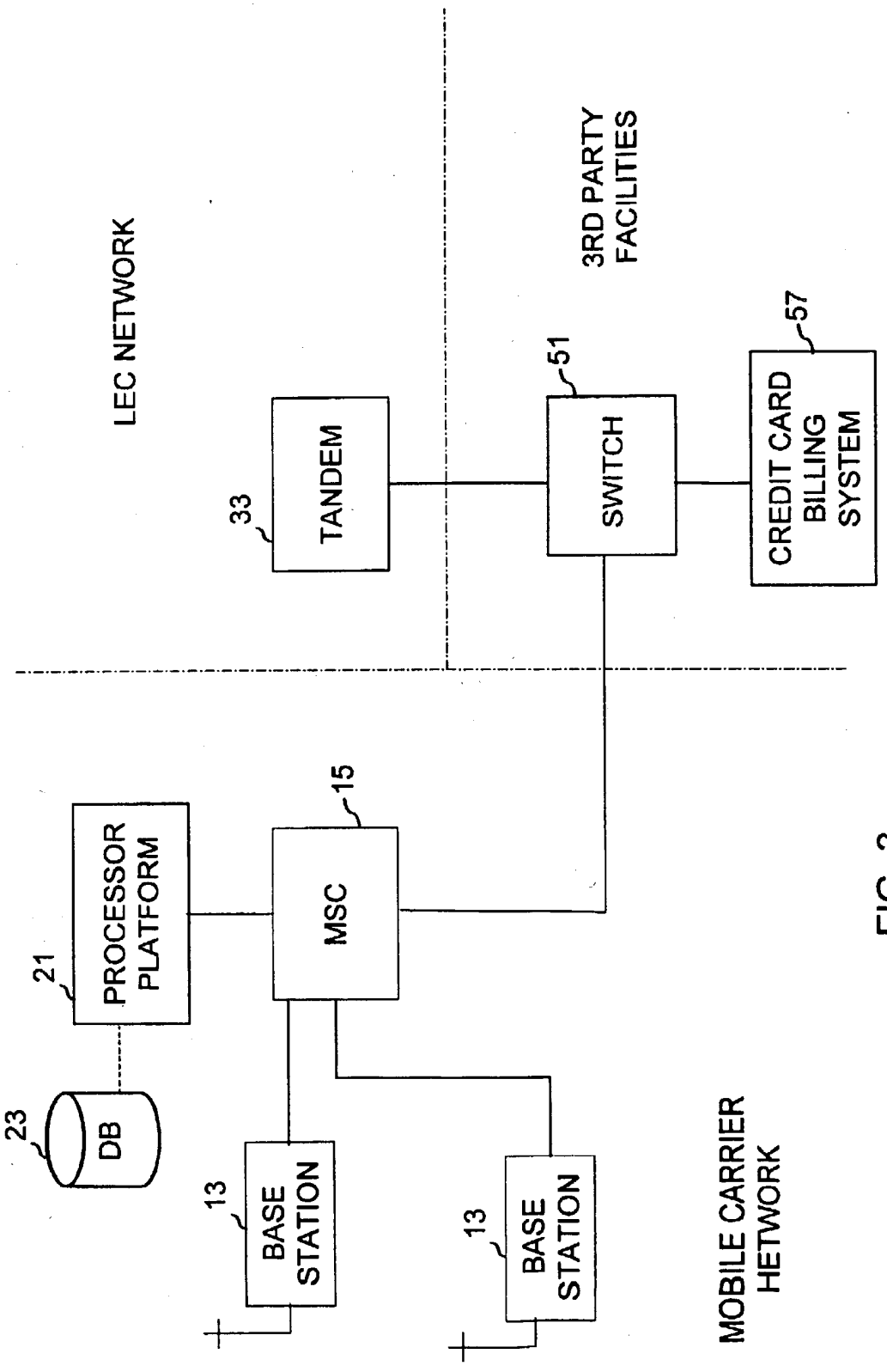

LEC NETWORK
3RD PARTY FACILITIES
TANDEM
33
SWITCH
51
CREDIT CARD BILLING SYSTEM
57
PROCESSOR PLATFORM
21
MSC
15
DB
23
BASE STATION
13
BASE STATION
13
MOBILE CARRIER NETWORK

FIG. 3

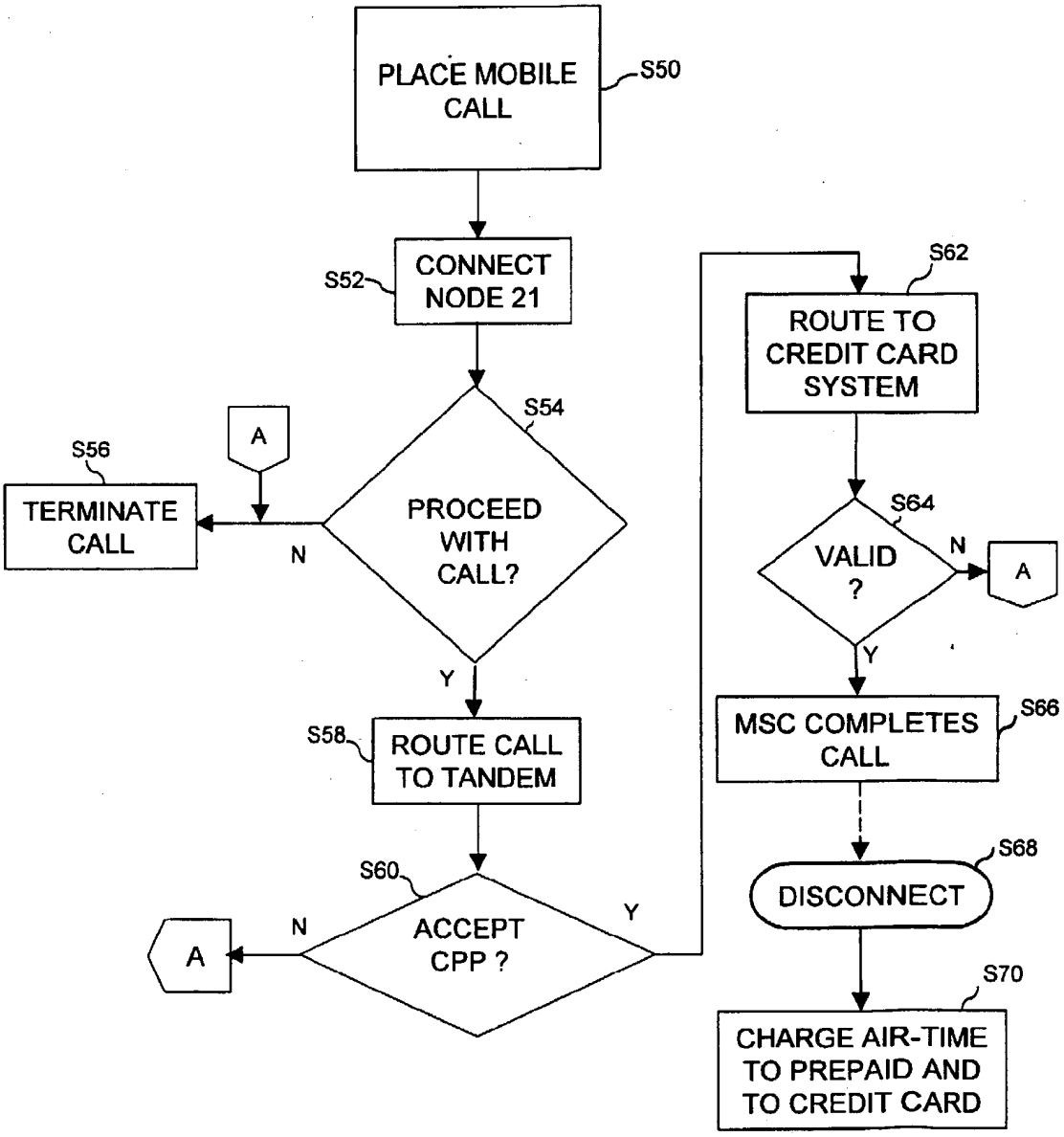

PLACE MOBILE CALL
S50
CONNECT NODE 21
S52
PROCEED WITH CALL?
S54
A
TERMINATE CALL
S56
N
Y
ROUTE CALL TO TANDEM
S58
ACCEPT CPP ?
S60
N
A
Y
ROUTE TO CREDIT CARD SYSTEM
S62
VALID ?
S64
N
A
Y
MSC COMPLETES CALL
S66
DISCONNECT
S68
CHARGE AIR-TIME TO PREPAID AND TO CREDIT CARD
S70

FIG. 4

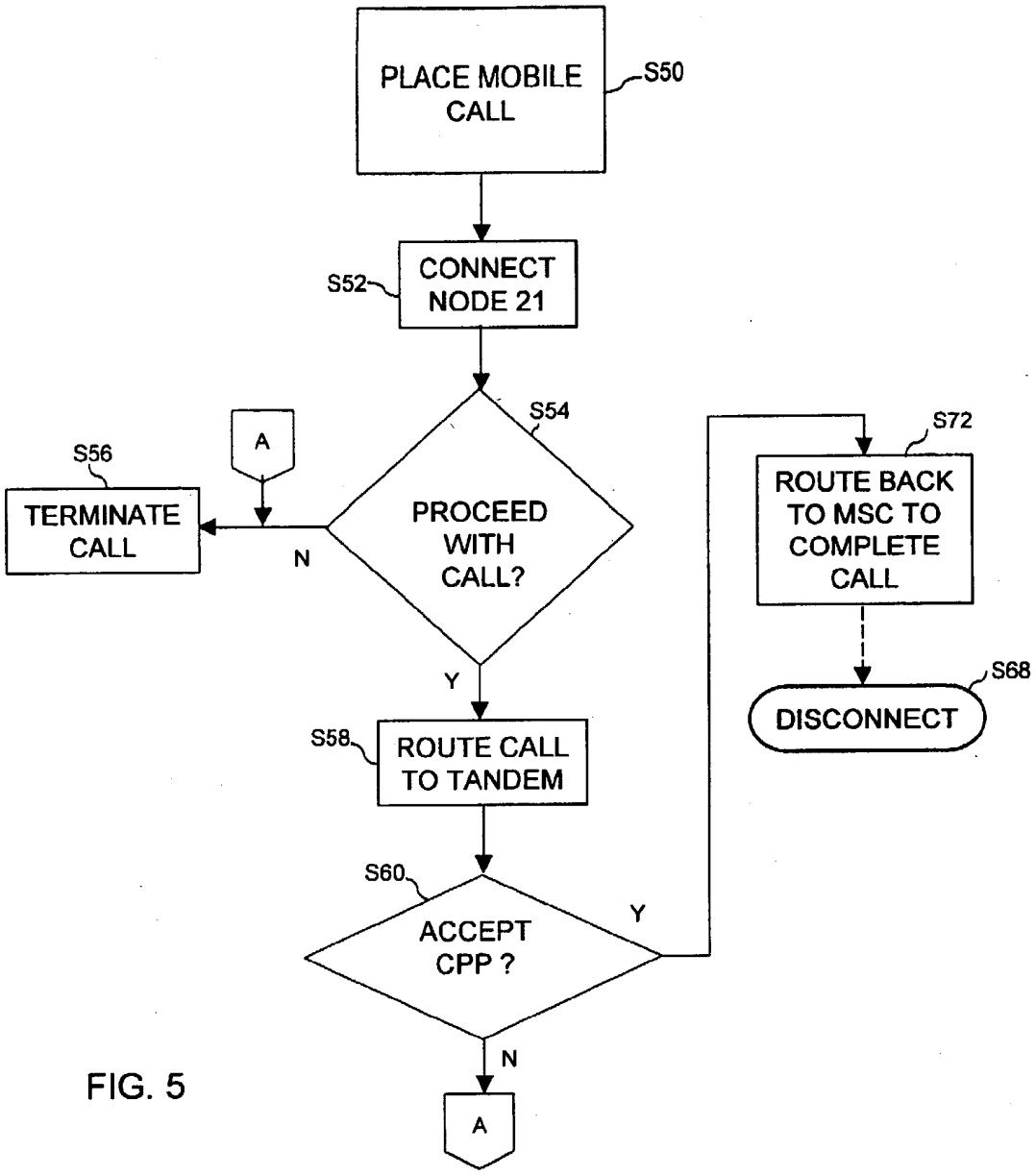

PLACE MOBILE CALL
S50
CONNECT NODE 21
S52
S54
PROCEED WITH CALL?
A
S56
TERMINATE CALL
N
Y
S58
ROUTE CALL TO TANDEM
S60
ACCEPT CPP ?
Y
N
A
S72
ROUTE BACK TO MSC TO COMPLETE CALL
S68
DISCONNECT

FIG. 5

MOBILE TO MOBILE CALL DELIVERY FOR CALLING PARTY PAYS WIRELESS SERVICE

RELATED APPLICATION

This application contains subject matter that is related to subject matter disclosed in U.S. patent application Ser. No. 09/456,550, filed Dec. 8, 1999, assigned to the assignee of the present invention.

FIELD OF THE INVENTION

The present invention relates to an enhanced network architecture for providing Calling-Party-Pays billing services for customers of a wireless telephone network, such as cellular or personal communication service (PCS) customers. More particularly, enhancements are provided for calls originating from wireless phone units that are directed to Calling-Party-Pays customer wireless units.

BACKGROUND

Wireless telephone communication systems have evolved from the initially introduced Advanced Mobile Phone Service (AMPS) technology to more sophisticated digital-based air interface protocols. Digital access technologies have been developed based on Time Division Multiple Access (TDMA) or Code Division Multiple Access (CDMA) schemes. Although these digital access technologies have advantages with respect to analog-based systems, they have not yet been deployed in as many regions as AMPS-based systems. However, digital cellular subscribers in many areas presently are offered continuous coverage via dual-mode wireless telephones capable of switching between a digital mode (e.g., CDMA) and an analog mode (e.g., AMPS).

Ordinarily, charges for wireless services air-time charges are applied to the party subscribing to the wireless service. The wireless carrier bills, either directly or through the local exchange carrier, a monthly subscription fee plus per-minute fees for telephone communications over-the-air to and from each subscriber's telephone. A wireless subscriber is charged for the air-time, both on outgoing calls and on incoming calls directed to the subscriber's cellular or PCS telephone. In contrast, call charges for landline telephone service usually are billed to the subscriber associated with the calling station. Alternative landline billing arrangements are available for collect call billing or 800/888 type "toll-free" calling.

The costs for wireless air-time has tended to be high, compared to costs for traditional landline telephone services. In light of high costs and the fact that charges are incurred for air-time on incoming calls, many wireless subscribers have been reluctant to distribute widely their wireless telephone numbers. Such subscribers tend to utilize their wireless telephone for outgoing calls, as needed, but disclose their wireless telephone numbers to a limited number of friends or family from whom they are willing to pay to receive calls. Calls from relatively unknown parties, e.g. solicitors and nuisance sources, thereby are avoided.

To overcome these issues and to Encourage increased wireless usage, the wireless industry has developed a modified billing arrangement, commonly referred to as "Calling Party Pays." The intent of the service generally is to shift the air-time charges for calls to wireless telephones from the wireless subscribers to the callers. The calling party would pay for all network charges, in a manner more like that used in the normal landline service billing. A number of techniques have been developed for processing and billing call charges on a Calling Party Pays basis.

For example, U.S. Pat. No. 5,353,331 to Emery et al. discloses an intelligent network type integrated wireless and wireline system for processing calls to and from a Personal Communication Service (PCS) subscriber's wireless handset via a home base station or a public cellular network. The service logic in the integrated service control point (ISCP) facilitates a variety of service enhancements to the wireless PCS service. One of the disclosed service enhancements is calling party pays. When the intelligent network functionality detects a call to the PCS customer's number, the network accesses a call processing record for that customer. Based on that record, the network screens the call based on the caller's identity. If the caller is not a recognized party, the ISCP database causes the network to play an announcement asking the caller if he or she is willing to pay all charges for the call. If the PCS subscriber is currently registered via a public wireless network switching office, the announcement would ask if the caller is willing to pay for the air-time necessary to complete the call via a wireless link. If the caller accepts the charges, the ISCP provides messages to a landline switch and/or to a mobile switch to instruct them to complete the call and to add charges for the air-time to the calling party's telephone bill.

U.S. Pat. No. 5,579,379 to D'Amico et al. discloses an AIN-based PCS service similar to the Emery arrangement. D'Amico adds further details to the calling party pays operations of that network. When a call directed to a mobile subscriber is detected, the call processing is stopped to determine if the calling party pays feature is in operation. At the same time, the network collects data regarding the calling party for analysis. If the called subscriber is using the calling party pays feature, the ISCP analyzes the caller data to determine if the caller is on a list of those individuals not required by the particular mobile service subscriber to pay for cellular charges. If the calling party does not fall in this category, the network provides an announcement to the calling party, asking the calling party whether or not the calling party is willing to pay for air-time necessary to complete the call. If the caller indicates willingness to pay for the air-time, the AIN network functionality obtains correct billing information, and the network completes the call and computes the cellular charges.

In systems such as those of Emery et al. and D'Amico et al., a landline carrier typically operates the intelligent network and performs the routing services, for certain aspects of the follow-me functionality of the PCS service. The carrier operating that network also performs the billing services related to the Calling Party Pays feature. If the caller is a subscriber of the landline carrier, that carrier adds the air-time charges to the subscriber's normal telephone bill. The landline network carrier, rather than the cellular carrier, bears the responsibility of billing the calling party.

U.S. Pat. No. 5,557,664 to Burns et al. discloses use of a central database to determine whether to bill a calling party or a called party for charges for completion of a call to a mobile telephone. The illustrated system includes switches of a local exchange carrier network, switches of an interexchange carrier (IXC) network, one or more mobile switching centers and a service processor with announcement facilities, service logic and a database. If a calling station dials a telephone number of a party who subscribes to the calling party pays service, the local exchange switches extend the call to the originating IXC switch. The originating IXC switch provides a message, containing the dialed telephone number, to the service processor. The service

processor retrieves a record corresponding to the dialed telephone number, and causes the announcement platform to provide an announcement regarding the pricing of the call through the network to the calling party. If the caller responds to the announcement by staying on the line to indicate acceptance of the charges, the service processor instructs the originating IXC switch to record billing information and notifies the billing system to charge the caller's account. The service processor also provides the mobile identification number (MIN) for completion of the call, to the originating IXC switch. The IXC network includes an indicator, preferably in the form of the dialed number, together with the MIN in the signaling to the mobile switching center, as an indication to inhibit normal billing for the call.

U.S. Pat. No. 5,473,667 to Neustein discloses a paging network. The system utilizes an automated attendant, which prompts a caller for desired information, to make a page. As part of the control of a paging operation, a central processor checks the profile of the paged party in the profile data base. The profile data enables the system to provide a number of enhanced services to paging service subscribers. In one of the enhanced services a paging party pays for the service on a per call basis. With the disclosed calling party pays type paging service, the caller calls the nearest central station and dials in the number of the pager he desires to page. The caller then enters his own billing number, for example his own telephone number or calling card number. If the billing number is valid, the system accepts an alphanumeric message or voice message from the caller and initiates paging of the called party's paging apparatus.

While all of the systems described above provide some level of effectiveness in billing for air-time to the calling party, each has certain practical limitations in actual use. When implemented in a real network, typically one carrier actually performs the calling party billing service for the wireless service provider. For example, using the Emery et al. type approach, a local exchange carrier might contract with a cellular carrier to perform the Calling Party Pays billing. In the Burns et al. system the IXC performs the billing. In the Neustein system, at least some billing is done through a separate credit card or calling card company. All of the prior art systems have been subject to some leakage, because invariably, the company processing the bills can not efficiently bill every type of caller.

As a practical matter, the carrier performing the bill processing function can pass the Calling Party Pays charges on only to those calling parties with whom that carrier has some type of existing billing arrangements. The local exchange carrier example actually provides the most effective solution, because on a very large percentage (typically 80–85%) of calls to the wireless telephone customers the callers are within the service area and are customers of the local exchange carrier. In such cases, the local exchange carrier can easily add the Calling Party Pays charges to the normal telephone bills for the callers. However, some calls will not originate from customers of the billing carrier. In the local carrier example, that carrier has no billing relationship with parties who make incoming calls through an interexchange carrier, parties calling from payphones, parties calling from a hotel or motel or hospital, parties served by a competing local exchange carrier, parties calling from other wireless networks, etc. Calls that the billing carrier can not process to bill the charges to the calling party are considered "leakage" with respect to the Calling Party Pays service.

The wireless carrier could elect not to complete calls that the billing carrier could not process for Calling Party Pays service (leakage), and the carriers would set the call processing logic accordingly. However, the types of incoming calls that the network completes are then limited. This blockage of certain calls affects the attractiveness of the Calling Party Pays service to wireless customers and sends a conflicting message to subscribers, particularly when the wireless carrier also is trying to encourage subscribers to widely distribute their wireless numbers to potential callers. To broaden usage in spite of leakage, some carriers have completed all incoming calls, and the wireless service carrier and/or the billing carrier has absorbed the leakage as a cost of doing business. The carrier(s) involved then must charge higher fees for the services or accept reduced profitability when compared to wireless services billed in the normal manner. Particularly from the point of view of the wireless carrier, who normally charges a per minute fee for all air-time, any completed but unbilled calling party pays calls essentially appear as lost revenues.

The other option for handling the problematic types of calls is to complete the calls to the subscriber but charge the air-time rates to the called subscriber. This approach is at odds with the purpose of the Calling Party Pays service. The subscriber would not know if an incoming call receives the Calling Party Pays treatment or accrues an air-time charge to the subscriber's own account. As a result, the wireless service subscribers would remain reluctant to distribute their wireless telephone numbers to large numbers of potential calling parties, who may call in such a manner as to still generate charges to the subscribers.

A need thus exists for systems and methodologies which enable one or more carriers to provide Calling Party Pays wireless services, with little or no leakage, i.e. no class of calls that the carriers cannot efficiently bill to the calling party. The above-identified copending application, Ser. No. 09/456,550, and incorporated herein by reference, addresses the above stated needs and overcomes the stated problems by providing a network architecture and call processing logic, which enable Calling Party Pays billing for calls to wireless subscribers including incoming calls that would otherwise leak through the billing operations of the principle carriers. A landline network routes incoming calls for a Calling Party Pays subscriber to the wireless carrier's network. The landline network recognizes each call that is subject to Calling Party Pays billing. If the carrier operating the landline network can bill a party associated with the calling station, that network routes the call to the mobile carrier's network and creates records for billing for the air-time. However, if the landline network cannot bill a particular calling party, the landline network hands the call off to another switch. This switch provides access to one or more alternate billing facilities. The alternate billing facilities preferably include a clearinghouse and a credit card billing system. A database indicates whether it is possible to bill for the air-time through the clearinghouse. If so, the switch completes the call to the mobile carrier's network and creates appropriate records to enable the clearinghouse to bill the air-time to the party associated with the calling station. If the caller is not billable through the clearinghouse, the switch extends the call to the automated credit card billing system. The credit card system makes all necessary records to bill the air-time charges for the call and bills the time against the caller's credit card account.

This arrangement as disclosed, however, would not provide the Calling Party Pays billing service in a call placed by a wireless station to another wireless station in the same system because no provision presently exists for passing such a wireless call to the landline local exchange carrier

(LEC). Instead, routing and completion of the call would transpire within the mobile system, thus bypassing the landline Calling Party Pays system. While this system could be modified to send all mobile to mobile calls out to the LEC for screening, such a provision would create a great amount of wasted trunk traffic for calls directed to mobile destinations that do not subscribe to the Calling Party Pays service. A screening process in which the centralized database is accessed to lookup a nonexistent record frequently would occur and the processing time taken to route a call to a non Calling Party Pays subscriber would be unnecessarily lengthened.

Alternatively, provision of a Calling Party Pays screening capability in a redundant database within the mobile system itself would have attendant drawbacks. Such a provision would incur additional expense to duplicate elements that still would be necessary in the landline environment to handle calls that originate from units other than mobile system sets.

A further complication with either of these alternatives would arise in the handling of a call placed by a prepaid mobile caller to a mobile Call Party Pays subscriber set. Prepaid phone calling charge cards for pre-established amounts are commonly available for purchase at various retail vendors. A mobile phone subscriber can purchase a set amount of credit in advance of actual usage. The purchaser would then register with the system by calling in from the mobile phone to which the credit is to be applied. After successful registration, the system automatically applies calling charges for subsequent usage of the phone against the registered credit on a real time basis. As the balance decrements to established thresholds by real time call rating, announcements are transmitted informing the user that the credit limit is being approached. Any call still in progress when the total prepaid amount has been used is automatically terminated. The initiation of a prepaid mobile call to a Calling Party Pays mobile destination poses a challenge in tracking air-time charges in real time for both calling and called party usage, which often are determined at different rates, and appropriately allocating all charges to the calling party.

SUMMARY OF THE INVENTION

The present invention fulfills the aforementioned needs. An advantage of the present invention is that calling party pays (hereinafter CPP) billing treatment can be applied to a call from a wireless subscriber station to a wireless subscriber station, even if the calling station subscribes to a provider other than the provider of the called station.

A further advantage of the present invention is that various landline billing facilities are made available for calling party pays calls from mobile callers, while avoiding the need to access a land line database for non-calling party pays mobile calls. Such advantage can be achieved without providing a redundant database in the wireless telephone network.

Yet another advantage of the present invention is that calling party pays billing treatment can be applied to a call from a prepaid wireless subscriber station to a wireless subscriber station. The air-time charges for both the calling and called subscribers can be rated on a real time basis and charged against the prepaid credit of the calling party.

These and other advantages are satisfied, at least in part, by linking landline facilities to a wireless mobile network for calling party pays calls between wireless subscriber units. The wireless mobile network is provided with the ability to recognize that a called wireless station is a calling party pays subscriber. Upon such recognition at the outset of a call, the wireless mobile network will route the call to a landline facility to undertake interactive communication with the calling station to determine whether the caller will agree to pay for both the called party's air-time charges and the calling party's air-time charges for the call. Caller authorization may be obtained, for example, by voice communication or by DTMF entry. The landline facility can then access a database to determine if the carrier with which it is associated can provide billing functions with respect to the calling subscriber and, if so, activate such functions for a carrier entity so identified. If the carrier cannot handle billing for the call, the call may then be routed to a clearinghouse facility, which either can itself handle the billing functions, if such an arrangement with the calling party has been previously established, or communicate with the caller to authorize billing charges to a credit card. The clearinghouse facility or an alternative processor platform can rate the call charges that will be applied to the credit card bill. The call can then be completed to the called station through the wireless communication network while rating of air-time charges for both calling and called parties takes place.

In a preferred embodiment, initial recognition by the wireless network that a call is a calling party pays call is made at a mobile switching center. Future development of wireless networks may provide advantageous network element alternatives for this purpose. In one preferred embodiment, a range of telephone numbers is predesignated for assignment to calling party pays subscribers. The mobile switching center is set to identify a mobile originated call directed to one number of the predesignated range as a calling party pays call. In another preferred embodiment, telephone numbers assigned to calling party pays subscribers need not be allocated to a range predesignated therefor. In the latter arrangement, calling party pays subscriber numbers will be given an immediate call forwarding status in the mobile switching center. The forwarding number is associated with the landline facility that will communicate with the caller to obtain authorization to bill the caller for the called party air-time charges. In both embodiments, calls to parties that do not subscribe to calling party pays service will not be identified by the mobile switching center for routing to the landline, but will instead be handled in normal fashion.

The wireless telephone network preferably contains a processor platform node that provides real time rating for calls from pre-paid mobile callers registered in a database associated with the node. Included in the database is the subscriber's credit balance which cannot be exceeded by subsequent usage charges. A link to the node will be immediately established upon placement of a pre-paid mobile subscriber call, as the existing credit balance for phone usage must be correlated on a real time basis. The link will be maintained for calling party pays calls after the caller has indicated to the landline facility that billing for the called party air-time charges is accepted. The node will perform real time rating for both calling and called party charges and provide notification to the caller when the caller's credit has been decremented to a predetermined level. Usage will be terminated upon exhaustion of the credit balance.

Additional advantages of the. present invention will become readily apparent to those skilled in this art from the following detailed description, wherein the preferred embodiments of the invention are shown and described, simply by way of illustration of the best mode contemplated

of carrying out the invention. As will be realized, the invention is capable of other and different embodiments, and its several details are capable of modifications in various obvious respects, all without departing from the invention. Accordingly, the drawings and description are to be regarded as illustrative in nature, and not as restrictive.

BRIEF DESCRIPTION OF THE DRAWINGS

The drawing figures depict the present invention by way of example, not by way of limitations. In the figures, like reference numerals refer to the same or similar elements.

FIG. 1 is a simplified block diagram of a telecommunication system in accord with the invention for providing Calling Party Pays services.

FIGS. 2A and 2B are portions of a flow chart of the call processing of a mobile-to-mobile CPP call in accordance with the present invention.

FIG. 3 is a block diagram of network architecture portions that are implemented in accordance with the present invention for processing prepaid mobile-to-mobile CPP calls.

FIG. 4 is a flow chart of call processing of prepaid mobile-to-mobile CPP calls according to the present invention.

FIG. 5 is a flow chart of call processing of pre-paid mobile-to-mobile CPP calls according to an alternative method of the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

The mobile-to-mobile CPP service capability of the present invention utilizes features and functionalities in a wireless telephone network in conjunction with, at least in part, system architecture and call processing logic described in the previously identified copending application Ser. No. 09/456,550, the disclosure of which has been entirely incorporated herein. FIG. 1 is a block diagram related to that system architecture and described below in relation to the present invention.

For simplicity of illustration, the wireless carrier network **1** is shown as comprising a pair of base stations **13**, connected to a mobile switching center (MSC) **15** that is interfaced and interconnected with landline networks. The wireless telephone network **1** preferably has the capability of providing analog, digital, or dual-mode network services. Wireless base stations **13** typically provide cellular or PCS radio coverage over the geographic area serviced by the network **1**. Communication between mobile subscriber terminals, or handsets, **11** at different base stations can be completed through the wireless network path between base stations and MSC **15**. The base stations **13** send and receive radio signals communicated to and from the compatible mobile stations **11**. The base stations **13** also communicate over trunk circuits to a mobile switching center (MSC) **15**. The MSC **15** controls the operations of the network **1** and provides selective switched connections. The illustrative drawing is representative of a wireless communication system that can provide service to a great number of subscribers **11**, through a plurality of bases stations **13** and MSCs **15**.

As part of normal operations, MSC **15** accumulates detailed call processing data for calls is completed through the wireless network. The data for a completed call, for example, will include an identification of the mobile subscriber, the called and calling party telephone numbers, the time of the call and the duration of the call. MSC **15** supplies this data to accounting office **17**, preferably through an appropriate data communication link. A billing computer operating in the accounting office **17** can process call records from various MSCs in the wireless network, to generate bills or invoices for delivery to the customers subscribing to the wireless carrier's services. The switched connections through the MSC **15** also provide selected call connections to the PSTN, for example to allow a user of mobile handset **11** to make a call to or receive a call from a landline telephone station.

Portions of a local exchange carrier network (LEC) **3** of the PSTN with which MSC closely interacts are represented in FIG. 1. The LEC telephone network includes a switched traffic network and a common channel signaling network that carries control signaling messages for the switched telephone traffic network. The telephone traffic network includes a number of end office type central office switching systems **31** and one or more tandem office type central office switching systems **33**. Subscriber stations, depicted as telephones **35**, are connected to the end office switches **31**. Each end office type central office switch **31** provides switched telephone connections to and from local communication lines or other subscriber links coupled to end users stations or telephone sets **35**. In the preferred implementation, the connections to the end offices **31** utilize telephone lines, and the switches **31, 33** are telephone type switches for providing landline communication. Of course, other communication links and other types of switches could be used, and the landline network **3** may be provisioned by a carrier other than the local exchange carrier.

Trunk circuits carry communication traffic between the end offices **31** and between the end offices **31** and the tandem switch **33**. At least one tandem also provides trunk connections between the LEC network **3** and other carriers' networks. At least one trunk is linked between tandem **33** and MSC **15** of the mobile or wireless carrier's network **1**. From the perspective of the network **3**, all calls to or from the mobile stations go through tandem **33**. Although not illustrated, tandem **33** may also provide connection to one or more interexchange carrier (IXC) networks.

The common channel interoffice signaling (CCIS) network portion of LEC **3** includes packet data links, illustrated as dotted lines, connected between appropriately equipped central office switching systems such as offices **31, 33** and a plurality of packet switches, termed Ad Signaling Transfer Points (STPs) **37**. To provide redundancy and thus a high degree of reliability, the STPs **37** typically are implemented as mated pairs of STPs. The CCIS network of the telephone system operates under an accepted signaling protocol standard, preferably Signaling System 7 (SS7). Each central office **31** or **33** has at least minimal SS7 signaling capability, which is conventionally referred to as a signaling point (SP) in reference to the SS7 network. The offices can exchange messages relating to call set-up and tear-down, typically in the format defined by the ISDN User Part (ISDN-UP) of SS7. At least some, and preferably all, of the central office switches **11** are programmed to recognize identified events or points in call (PICs) as advanced intelligent network (AIN) type service triggers. In response to a PIC or trigger, a central office **31** or **33** initiates a query through the CCIS signaling network to a control node or a database system, for instructions or information relating to AIN type services. Central office switching systems having full AIN trigger and query capability are referred to as Service Switching Points (SSPs). For purposes of the CPP service, at least the tandem **33** has full SSP capability. MSC **15** of the wireless carrier network **1** has signaling capability and connects by SS7 signaling links to the STP pair **37** of the LEC network **3**. Although not shown, the MSC **15** link can include an IXC STP path.

The databases or other control nodes of the AIN used in networks such as the LEC network **3** include a number of different types of systems facilitating an increasingly sophisticated range of new services. One example of a control node is the Service Control Point (SCP) **39**. Another common example of such an AIN database system is a Line Identification Data Base (LIDB) **41**. Reference is again made to the earlier identified copending application for a more detailed description of the SCP **39**. SCP **39** and LIDB **41** may communicate with each other through private data network (PDN) **43**. PDN **43** may be a packet switched data network, such as the TCP/IP network.

The LIDB database **41** is a general-purpose computer system having a signaling link interface or connection to a pair of STPs **37**. The LIDB computer system runs a database program to maintain a database of information relating to customer accounts and identifications. For example, a subscriber's entry in the LIDB database might include the subscriber's telephone number, a personal identification number for credit card billing purposes, and the subscriber's name and address. The LEC LIDB **41** may contain one such record for each of the LEC subscribers with a defined service area. The LIDB **41** also contains a record for each wireless subscriber who subscribes to the CPP service. The record for each such wireless subscriber may be accessed by means of the wireless subscriber's mobile telephone number.

In a normal call in the LEC network **3**, an end office type switch **31** will detect an off-hook condition on the line and provide dial tone. The switch **31** identifies the line by its office equipment (OE) number and retrieves profile information corresponding to the OE number and off-hook line. If needed, the profile identifies the currently assigned telephone number. The switch in the end office **31** receives dialed digits and routes the call. The switch may route the call to another line serviced by that switch, or the switch may route the call over trunks and possibly through one or more tandem offices **33** to an office **31** that serves the called party's station or line.

AIN call processing involves a query and response procedure between an SSP capable switching office and a control node or a database system, such as the SCP **39** or the LIDB **41**. An SSP capable switching office will initiate AIN involvement upon recognizing a triggering event at a PIC during call processing. The triggering event effects a query to the appropriate node **39** or **41** to obtain a return instruction to the switching system for continuing call processing. A variety of types of triggers are available. The SCP **39** provides instructions relating to AIN type services. The LIDB **41** typically provides subscriber account related information, for calling card billing services or for subscriber name display purposes in an enhanced caller ID application.

In a call placed to a telephone number of a wireless or mobile station **11** from a landline terminal **35** of LEC network **1**, the serving end office **31** recognizes the NPA-NXX digits in the dialed number as those of a carrier served through the tandem **33**. The end office **31** responds by routing the call to the tandem **33**. In normal call processing, the tandem would route the call to the MSC **15** for completion to the destination station **11** without intervention by AIN triggering. If the called party is a CPP subscriber, however, AIN call processing, preferably triggered in the tandem **33**, is relied upon for processing the call. The presence of an account record for a subscriber of the mobile carrier in the LIDB **41** serves as an indication that a particular subscriber telephone number of the wireless carrier has an associated subscription to the CPP service. The AIN call processing logic within the SCP **39** then makes several determinations, which are used to decide how to proceed. For example, the SCP logic recognizes if the particular caller agrees to pay the charges and whether or not the LEC can bill the calling party. If appropriate, the SCP logic also may determine whether or not an exception applies to the CPP billing treatment for the specific call.

In normal operation, a switch examines a customer's service request, typically the destination telephone number and, based on customer profile or service information, determines if there is a need for AMA recording for the call, for example if the call is a long-distance call. If the call involves signaling communication with an SCP, an instruction from the SCP can override the normal decision process regarding AMA recording. For CPP calls, the SCP **39** can instruct the tandem switch **33** to make AMA records to enable billing calling LEC customers for air-time charges of the called party., AMA records are transported to a regional accounting office (RAO) **45**. While such records may be stored on data tapes that are physically transported, switches preferably are provided with an appropriate data transfer link to allow electronic communication of the records to the RAO **45**. The generation and accumulation of AMA record details and the various components of the RAO. are generally well known.

To provide for rating and billing of calls that would otherwise "leak" through the CPP operations of the networks **1** and **3**, the system of FIG. **1** also utilizes certain additional facilities that may be provided by one or more third parties, collectively identified by the network portion **5**. The third party billing entity network provides access to at least two billing alternatives for CPP calls that can not be billed by the LEC. In one alternative, billing functions are handled through a clearinghouse for non LEC subscriber callers who have pre-established relationships with the clearinghouse. The other alternative provides automated credit card processing, wherein interactive communication is conducted to obtain from the caller identity of a credit card account and authorization to bill thereto air-time charges for the called party. The functions of these alternatives and the elements of the third party billing network may be under complete or partial control of the clearinghouse.

Switch **51** of the third party network is generally similar in structure and operation to the switches of the LEC network **3**. The switch **51** has normal telephone switching capabilities. The switch **51** may also have rating and data recording capabilities, which might be provided for example by AMA recording equipment in a telephone switching office. The switch **51** provides AMA records of certain CPP calls to a clearinghouse **53**, for bill processing. Switch **51** connects through trunk circuits to both the LEC tandem **33** and the MSC **15**. The switch **51** also communicates call set-up signaling with both the LEC tandem **33** and the MSC **15**. The signaling may be in-band, but preferably uses SS7 communications, for example, through one or more STPs **37** of the LEC and/or another CCIS service provider (not shown).

The third party facilities **5** also include a database (DB) **55**, which may be similar to the LIDB, but maintained by the third party. The database DB identifies all customers that the third party can bill through the clearinghouse **53**. The switch **51** and database DB **55** may be implemented by a central office switching system and an intelligent network database system communicating via SS7, similar to the systems of the LEC, for example if the third party service provider is another carrier offering its own variety of telecommunication services. Alternatively, the third party may provide only

the switch and database together with data communications to the clearinghouse. In such a case the third party may use other implementations of the switch **51** and database DB **55**, such as an integrated unit with both telephone switching and database look-up capabilities.

In a CPP call, when the LEC tandem **33** routes the call to the switch **51**, the systems of LEC network **3** already have determined that the calling party has agreed to pay the air-time charges but the LEC can not bill the particular subscriber associated with the calling station. The switch **51** executes a routine to access the database **55** to determine if the third party can bill the calling station subscriber via the clearinghouse. If so, the switch **51** completes the call through the MSC. At this time, the switch makes the AMA records for later delivery to the clearinghouse system **53** and provides the signaling to the MSC **15** to suppress its normal data reporting regarding billing.

If the call can not be billed through the clearinghouse, automated credit card billing system **57** is invoked. The switch **51** provides selective call connections, for voice grade communications with callers, to the credit card billing system **57**. The system **57** is a standard system for providing voice prompts, to callers and collecting dialed digit or spoken information, for example, to obtain a credit card number from a caller. The system may also obtain expiration date and a PIN relating to the caller's credit card account. The system **57** communicates with existing credit card company equipment to verify account status and apply accrued charges to identified credit card accounts. The system **57** also includes telephone call rating equipment, to time telephone calls processed through the system **57** and calculate costs for such calls, including the billable air-time charges. The system **57** remains in the call connection in order to time rate the call. The switch **51** does not make AMA records, but signals the MSC **15** to suppress its normal data reporting regarding billing. The billing system **57** accumulates the necessary records regarding the call and charges appropriate fees to the caller's credit card account.

Calls placed to a telephone number of a wireless or mobile station from a calling wireless station in a mobile system conventionally are handled internally. That is, call routing remains within the system, apart from the LEC PSTN. This conventional routing process, as previously discussed, does not satisfactorily provide for a CPP call from a mobile caller to a mobile called party. In accordance with the present invention, the architecture of FIG. **1** is utilized to overcome this deficiency. The wireless network does not require redundant duplication of landline facilities. Instead, the landline network, illustrated in FIG. **1**, is accessed through recognition in the wireless network that a mobile call is being placed to a CPP mobile subscriber.

FIGS. **2**A and **2**B are portions of a flow chart summarizing call processing of a CPP call originating at a mobile call unit. At step **S1**, a call is placed at a mobile handset to a mobile telephone number. A determination is made (step **S3**), preferably at the mobile switching center, of whether the called party is a CPP subscriber. The manner in which CPP status of the call can be recognized is described below. If the call is determined to be directed to a mobile station that does not subscribe to CPP service, the call remains in the wireless network system to be processed in conventional fashion (step **S5**). When the call is answered, the MSC creates the data records necessary to bill the called party air-time charges for the call to the called subscriber. The MSC will complete the call and record the caller's air-time to be billed to the caller. The charge data for both parties are forwarded to the accounting office **17**, for bill processing.

If it is determined at step **S3** that the call is a CPP call, the call is routed through the MSC **15** to tandem **33** at step **S7**. At step **S9**, the tandem **33**, through interaction with appropriate landline network resources, determines whether authorization must be sought from the caller to be billed for the air-time charges for the called party. For example, by virtue of identifying the trunk from which the call has been routed as an MSC link, the tandem is alerted that additional treatment by the tandem is required. The tandem, through the AIN network, can then access SCP **39** and LIDB **41** to establish that the call is a CPP call. Wireless CPP service subscribers have associated records in the LIDB database. A record may include a VIP list that indicates that the calling party is to be unconditionally excluded from CPP charges or that exclusion is predicated upon any of a number of conditions. For example, exclusion may require obtaining a PIN or other identifying information from the calling party. Exclusion may also be linked to geographical considerations. The record for the called party is checked for calling party number CPP exclusion information. If the call is excluded CPP status without requiring input from the caller, the negative outcome of decision step **S9** directs the flow chart branch back to step **S5** to complete the call processing without further treatment in the land line network.

If caller authorization is required, an interactive session is undertaken at step **S11** between the tandem **33** and the caller. A recorded announcement can be transmitted that informs the caller of the CPP status of the call and requests the caller to accept billing for the calling party's air charges or to respond with information that would exclude the caller from such billing, such as PIN identification, for comparison with information in the SCP or LIDB databases. This step can be implemented by connecting the call from switch **33** either to an internal announcement platform (not separately shown) or an external platform, such as an intelligent peripheral, to provide the announcement. The caller's response may be input by DTMF keying or by voice, as the tandem has capability for voice recognition as well as DTMF signal recognition. At step **S13**, the tandem determines whether the caller has accepted responsibility for payment of the called party's air charges for the call. A negative outcome in that step may result from either a refusal to pay for such charges or a response by the caller that qualifies as an exclusion from CPP status, such as. valid PIN number, as illustrated by the decision block step **S15**. If the caller is excluded from CPP status, the flow chart reverts to step **S5** for call completion as previously described. The caller may indicate refusal to pay for the called party charges either by verbal or DTMF response or simply by hanging up. If step **S15** determines that the call maintains its CPP status but that the caller has not agreed to pay for the called party's charges, the call is terminated at step **S17**.

If step **S13** indicates that the caller will accept billing for the called party's billing charges, the process branches to step **S19** (FIG. **2**B), wherein the LEC SCP is accessed to determine whether the LEC can bill the calling party. Mobile users generally subscribe to wireless carriers that do not populate records in the LEC database. However, in some instances cooperative arrangements between the carriers for such purposes may exist, possibly to a greater extent in the future as closer relationships among these entities develop. The SCP may make this determination of billing capability from LEC data records stored in the SCP **39**, or the SCP may communicate with the LIDB **41** through the private data network **43**, essentially to reference the calling party billing record within the LIDB.

If the LEC can bill the caller, the SCP **39** returns an instruction to the LEC tandem **33**, which causes several

actions by the LEC tandem to act as the billing facility. The tandem **33** initiates AMA recording for the call within the tandem at step **S21**. The tandem will record all necessary information to enable billing for the call to the LEC's calling subscriber. For example, at this point, the tandem **33** makes an initial AMA journal entry recording the calling and called party numbers. The tandem **33** also provides special signaling to the MSC **15** at step **S23** to complete the call to the called party. As the LEC will supervise the billing to be allocated to the calling party, LEC tandem **33** is provided with rate information for both the calling and called parties. As there is thus no need for the MSC to record air-time, signaling step **S23** indicates, for example by setting a flag in the signaling message, to the MSC not to record air-time. It is preferable, from the perspective of billing efficiency, that the tandem handle air-time charges for both parties. However, other conditions may dictate desirability for maintaining the recording function for the caller's air-time with the MSC. For example, the LEC may not have access to both the calling and called parties' air-time rates. Thus signaling step **S23** may indicate some apportionment of billing responsibilities to the MSC.

At step **S25**, the MSC **15** completes the call without recording air-time in the illustrated embodiment. When the called station answers, the billing facility makes an answer entry on its AMA journal entry, to register the time of initial connection. At a later time, one or the other of the parties to the completed call ends the connection, typically by hanging-up (step **S27**). The various offices of the networks **1, 3** take-down the link between the stations. At this time, the billing facility makes a terminating entry on its AMA journal, to register the time of disconnect. At step **S29**, the billing facility uploads all entries from its AMA journal relating to CPP calls to an appropriate regional accounting office. A common identifier in each entry for a particular call serves to link the entries relating to the call, to distinguish them from those of other calls. The RAO executes a series of processing steps (not shown) to assemble the messages regarding a call into a set and from the message set compile a billing record for inclusion on the calling subscriber next monthly invoice.

If it is determined at step **S19** that the LEC can not bill this caller, the flow chart branches to step **S31**, wherein the call is routed further from tandem **33** to switch **51** via a trunk group connected therebetween. The SCP **39** transmits a response message back to tandem **33** that indicates inability of the LEC to assume billing functions. The tandem **33** provides all of the necessary information regarding the call to switch **51**, via standard interoffice signaling, preferably using ISDN-UP messages over SS7 links. At step **S33**, switch **51**, having received the call from tandem **33**, queries database **55** maintained by the third party network. This database identifies all customers that the third party can bill through the clearinghouse. The flow chart will branch will branch from step **S33** on the basis on whether or not the call is billable to the caller through the clearinghouse **53**.

If the third party can bill the caller through the clearinghouse, database **55** returns a message informing the switch **51** of the billable status. At step **S35**, switch **51** initiates AMA recording for the call. The remainder of the call processing essentially reverts to steps **S23–S29**, wherein switch **51** routes the call to the MSC **15** over an appropriate trunk with signaling instruction for MSC **15** not to record call data for billing the air-time to the called party. The MSC **15** will complete the call to the called station **11** without recording billing information. Upon disconnection, the clearinghouse billing facility assembles billing information for the call for invoice processing by the appropriate accounting office. With respect to billing and invoice functions, the clearinghouse may operate in similar fashion to the LEC tandem and accounting offices.

If the clearinghouse database **55** does not contain an appropriate record for the calling party, step **S33** will indicate that the clearinghouse cannot bill the caller for air-time charges. The call then will be routed by switch **51** to credit card billing system **57** at step **S37**. At step **S39**, the credit card billing system **57** interacts with the caller to obtain a credit card number and any other information necessary to enable billing for the costs against the caller's credit card. This interaction may involve announcements providing instructions to the caller and receipt of dialed digits or spoken answers as inputs from the caller. The system **57** may communicate with existing credit card company equipment to verify account status. If the caller hangs-up or cannot provide appropriate credit card information, as determined at step **S41**, the call is terminated at step **S43**.

If a credit card transaction has been successfully undertaken as indicated by a "Y" branch in step **S41**, the system **57** initiates call-rating at step **S41** and provides an instruction to the switch **51**. Thereafter, processing continues in similar manner to the above-describes steps **S23–S29**. The MSC **15** completes the call to the called station but, in accordance with signaling received via switch **51**, the MSC does not record information about the call for billing purposes. Because the credit card billing system **57** remains connected to the call, the system **57** will recognize when the caller answers. At that time, the credit card billing system initiates the timing for its call rating function, as represented by step **S45**. Upon disconnect, the link between the calling and called stations is taken down and the billing system **57** ends its timing of the call. The call rating equipment in the system **57** calculates the costs the completed call, including the billable air-time charges for both parties and prepares a credit card bill. The system **57** may communicate the costs to existing credit card company equipment, to apply accrued charges to the caller's identified credit card account.

In accordance with the present invention, the mobile switching center preferably may determine whether a dialed call is a CPP call, at step **S3**, in at least two alternative approaches. In order to distinguish a CPP from a non-CPP call in one preferred mode, CPP subscribers are assigned telephone numbers from an allocated range of numbers that are predesignated for this purpose. The mobile switching center will identify the number range in its stored database. Any call having a destination number that matches the number range is directed to the tandem trunk. As the predesignated number range should be large enough to accommodate the number of CPP subscribers, expansion of the allocated range may require consideration as the number of subscribers of the service increases. A second alternative does not limit the amount of telephone numbers that can be allocated to CPP subscribers. With the latter embodiment, each CPP subscriber number is set in the mobile switching center with an immediate call forwarding status that causes an incoming call to that number to be forwarded by the MSC to the tandem trunk. The tandem, in both of these arrangements, may originate its call processing functions in response to recognition that the trunk from which the call has been received is a dedicated CPP trunk. In lieu of a dedicated trunk, appropriate signaling can be included with the routed call to initiate the appropriate tandem call processing functions.

Immediate call forwarding status can be set at the mobile switching center, for example, by insertion of an additional

digit in the subscriber profile stored at the switch. The MSC thus can recognize an incoming call having the extra digit as a CPP call and forward the call to the LEC tandem destination, with the extra digit stripped from the called number signaling information transferred to the tandem. When the call ultimately is to be connected to the called party, after CPP and billing authorization has been established, appropriate signaling can be provided to suspend the call forwarding status for the call at the MSC so that the call will be completed to the called party. Alternatively, identification of the return trunk can be used to suspend the call forwarding status when the MSC completes the voice path to the called party.

An additional aspect of the present invention is the implementation of CPP treatment to mobile calls originating from a prepaid mobile user. Mobile users may individually purchase, from various retailers, a selected credit value against which future charges for air time usage will be applied. Prepaid usage has become increasingly popular. To ensure that usage does not exceed the purchased amount, and to keep the user informed of the remaining usage time available, the mobile switching system includes a dedicated processing platform. FIG. **3** is a partial block diagram illustrative of the prepaid architecture in the context of the present invention. Processor platform (node) **21** is connected by a trunk group to mobile switching unit **15**. Database **23**, which serves node **21**, is connected thereto by a data communication path. Database **23** contains records for all registered prepaid customers. The records store credit available and air-time rates. After purchase of prepaid usage, the customer will call the system to register and establish a record in the node database. This call is routed to the processor platform, which will identify the customer's telephone unit and purchase amount to be stored in a new customer record in the database. The customer's telephone number or equivalent will be set in the mobile switching center so that future calls from the customer unit will be recognized as originating from a registered prepaid account user. The processor platform will be linked with calls originating from the prepaid customer unit to perform a real time rating of air usage in accordance with the appropriate rate. In conjunction with the database **23**, the processing platform obtains the rate information and credit balance at the beginning of the call and updates the database upon call completion. The platform retains voice communication capability with the caller throughout the call to announce the remaining call minutes available.

Billing for calls from prepaid mobile users to CPP mobile destinations imposes additional complexities. FIG. **4** is a flow chart illustrative of one method for processing such calls in accordance with the present invention. At step **S50** a prepaid user places a call to a CPP destination. MSC **15** recognizes the call as originating from a registered prepaid user and connects the call to node **21** at step **S52**. The processing platform accesses the associated database to retrieve credit and rate information for the calling party and interacts through the voice communication link with the caller. The credit balance and remaining minutes available are related to the caller and a decision is made as to whether the call is to proceed. These functions are represented by step **S54**. If the credit balance is insufficient for the caller's intended use, the call is terminated at step **S56**. If the call is to be processed the MSC then identifies the call as a CPP call in a manner described above. At step **S58**, the call is then routed to tandem **33**, which engages voice communication with the caller to announce that the called party is a CPP customer and to obtain the caller's acceptance of the CPP arrangement. If decision step **S60** indicates refusal of the caller to accept the CPP arrangement, the call is terminated. In response to a positive outcome in step **S60**, the call is routed from the tandem **33** to the credit card billing system **57** through switch **51** at step **S62**. Interaction between this system and the caller proceeds as previously described to determine at step **S64** whether a valid credit card is authorized for application of charges for the called party's air time charges. If validation fails, the call will be terminated. If the credit card charge is authorized, signaling is undertaken with the MSC to complete the call at step **S66**. The call is routed to the called party. During the course of the call until disconnection at step **S68**, the node **21** processor rates the air-time charges for the calling party on a real time basis, applying the charges against the caller's prepaid credit balance. The called party's air-time charges are tracked by the credit card system to be applied to the caller's credit card bill. These rating and billing functions are represented by step **S70**.

In this method, the prepaid processing node tracks the caller's air usage in real time without regard to the charges accumulated by the called party air-time usage. Advantages to separately billing the latter charges to the caller's credit card account are that the prepaid credit balance can be conserved and that the processing node **21** need not be involved in the rating process and billing records for the called party usage. As an alternative method of the present invention, processing node **21** handles the real-time rating of both calling and called party air-time usage, applying the charges dynamically against the caller's prepaid credit balance. This alternative provides advantages for use with relatively large credit balances. Application of two rates for the call is well within the capability of the processing platform; the use of trunk communication and the delay of signaling to third party facilities are obviated.

FIG. **5** is a block diagram of this alternative embodiment. Elements that perform as described above with respect to FIG. **4** bear the same reference numerals and need no further detailed discussion. As in the operation illustrated in FIG. **4**, upon placement of a mobile call, the processing node is linked by the MSC for rating the prepaid call. Upon acceptance of the CPP arrangement by the caller, as determined by the tandem **33** at steps **S58** and **S60**, the call is routed back to the MSC to complete the routing to the called party at step **S72**. Communication between the MSC, which has recognized that the CCP status has been accepted, and the processing platform **21** alerts the latter to commence real-time rating of the air charges for both calling and called parties. Both charges are dynamically applied against the caller's credit balance throughout the call until disconnection. The node communicates with the caller as the credit balance decrements to predesignated threshold levels, as done with ordinary prepaid calls.

Those skilled in the art will recognize that the present invention admits of a number of modifications, within the spirit and scope of the inventive concepts. In the above discussed examples, the various switches recorded call related data using AMA recording equipment and procedures. Those skilled in the art will recognize that other techniques may be used to accumulate the data regarding the time, duration and called/calling party numbers for billing by the carrier and/or for billing through. the clearinghouse. For example, in a prepaid mobile caller CPP call, the system can be arranged to provide rating of the called party's air-time charges by either the processing node **21** or a credit card system depending upon factors such as remaining prepaid credit balance or charge rates. As a further

modification, the clearing house could be used in lieu of, or in combination with, the credit card system to rate and bill the caller for the called party's charges.

While the foregoing has described what are considered to be preferred embodiments of the invention it is understood that various modifications may be made therein and that the invention may be implemented in various forms and embodiments, and that it may be applied in numerous applications, only some of which have been described herein. It is intended by the following claims to claim all such modifications and variations which fall within the true scope of the invention.

What is claimed is:

1. For a wireless telephone network including a mobile switching center for interfacing a wireless base station with a landline network, a method for processing a telephone call placed from a wireless telephone calling station to a wireless telephone called station comprising the steps of:

in response to initiation of said telephone call by said calling station, a first determining step of determining in said wireless telephone network whether said called station subscribes to calling party pays billing service;

in response to an indication in said first determining step that said called station subscribes to calling party pays billing service, routing the call from the calling station to a predetermined switching office of the landline network;

a second determining step of determining at said predetermined switching office whether authorization to bill the calling station is required;

communicating between said predetermined switching office and said calling station to decide whether authorization is given by said calling station to bill said calling station for charges for the call;

in response to receipt of said authorization in said communicating step, establishing a billing facility for applying charges for the call and issuing a bill in accordance therewith; and

completing the call to the called station through the wireless communication network.

2. A method as recited in claim **1**, wherein said first determining step is performed at the mobile switching center.

3. A method as recited in claim **2**, wherein said calling station is a pre-paid subscriber and said billing facility comprises a processing platform, having a database associated therewith, connected to said mobile switching center, and wherein said step of establishing comprises accessing the database associated with said processing platform.

4. A method as recited in claim **1**, wherein, in response to an indication in said first determining step that said called station does not subscribe to calling party pays billing service, routing the call from the calling station to the called station through the wireless telephone system.

5. A method as recited in claim **1**, wherein calling party pays billing service subscriber stations are allocated telephone numbers within a predetermined number range and said first determining step comprises recognizing that the called number is within said predetermined range.

6. A method as recited in claim **1**, wherein calling party pays billing service subscriber stations are assigned telephone numbers having a call forwarding status, and said first determining step comprises recognizing said call forwarding status.

7. A method as recited in claim **6**, wherein said call forwarding status identifies said predetermined switching office as a routing destination and said recognizing step is performed at the mobile switching center.

8. A method as recited in claim **1**, wherein step of communicating comprises sending a message from said predetermined switching office to said calling station and receiving a response at said predetermined switching office from said calling station.

9. A method as recited in claim **8**, wherein said response comprises a voice transmission.

10. A method as recited in claim **8**, wherein said response comprises a DTMF signal transmission.

11. A method as recited in claim **1**, wherein said billing facility resides in a local exchange carrier network.

12. A method as recited in claim **1**, wherein said billing facility comprises a clearinghouse system.

13. A method as recited claim **1**, wherein said billing facility comprises a credit card system.

14. A method as recited claim **1**, wherein said step of establishing comprises:

accessing a database in a local exchange carrier network (LEC) to seek a determination that the LEC can bill charges to a party associated with the calling station;

in response to said determination in said accessing step, applying a LEC billing facility to supervise rating charges for the call;

in the absence of said determination in said accessing step, routing the call to a clearinghouse facility; and

accessing a database associated with said clearinghouse facility to seek an alternate billing entity.

15. A method as recited claim **14**, wherein the clearinghouse facility database contains entries of telephone subscribers with which the clearinghouse billing arrangements, and further comprising the steps of

in response to a determination that the clearinghouse facility database does not identify the calling station as an alternate billing entity, commencing an interactive voice link between said clearinghouse facility and said calling station; and

obtaining authorization from the calling station through said interactive voice link to apply charges for the call to a valid credit card.

16. A method of providing a calling party pays billing treatment on a call placed by a calling wireless telephone station to a called wireless telephone station comprising the steps of:

determining in a wireless telephone network that the called station is a calling party pays subscriber station;

routing the call from the wireless telephone network to a landline facility of a public switched telephone network;

obtaining at said landline facility authorization from the calling station to charge the calling station for the call;

establishing a billing facility for supervising billing functions for the call; and

completing the call to the called station.

17. A method as recited in claim **16**, wherein said determining step comprises recognizing at a mobile switching center of said wireless telephone network that the telephone number of the called station is among a range of telephone numbers predesignated for calling party pays subscribers.

18. A method as recited in claim **16**, wherein said determining step comprises associating at a mobile switching center of said wireless telephone network that the called telephone number is associated with an immediate call forwarding feature and said routing step is performed in

response to activation by the mobile switching center of the immediate call forwarding feature.

19. A method as recited in claim **16**, wherein said billing facility is operated by a landline local exchange carrier.

20. A method as recited in claim **16**, wherein said billing facility is operated by a clearinghouse system.

21. A method as recited in claim **16**, wherein said calling station is a prepaid subscriber and said billing facility comprises a processing platform having a database associated therewith containing records of prepaid subscribers and their respective credit balances, and further comprising the steps of

maintaining a link between said processing platform and a mobile switching center for said call;

rating in real time at said processing platform both caller and calling charges; and

notifying said calling station during progress of said call when the remaining prepaid credit for said calling station has decremented to a predetermined threshold.

22. A method as recited in claim **21**, wherein said processing platform is in the wireless telephone network and connected to said mobile switching center.

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